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SURVEY OF INDUSTRIAL WASTE INJECTION WELLS. VOLUME I.

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SURVEY OF INDUSTRIAL WASTE INJECTION WELLS

VOLUME I

by
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June 1972

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Final Technical Report on

"Survey of Industrial Waste Injection Wells"

U. S. Geological Survey Contract

14-01-0001-12280 ($26,678.00)

Jan. 1, 1971 -- June 30, 1972

Details of illustrations in
this document may be better
studied on microfiche

Submitted by

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To

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June 1972

INTRODUCTORY STATEMENT

This report consists of 246 forms, each eight or more pages long, describing individual wastewater injection wells that have been inventoried. The following table lists the 22 states in which wells are known to exist and the number of wells inventoried in each of the 22 states. The forms are grouped by state and arranged approximately chronologically within each state.

Alabama	5	Nevada	1
California	4	New Mexico	1
Colorado	2	New York	4
Florida	5	North Carolina	1
Illinois	5	Ohio	8
Indiana	12	Oklahoma	9
Iowa	1	Pennsylvania	8
Kansas	27	Texas	71
Kentucky	3	Tennessee	4
Louisiana	40	West Virginia	7
Michigan	27	Wyoming	1
			246

There are presently more than 246 wells in existence, because this study has been carried out over a period of 18 months, and during that time additional wells were constructed in Texas, Louisiana, Michigan, Indiana, Illinois, and perhaps other states, after the time at which wells in those states were described. All wells that have been constructed for injection of industrial wastewaters into saline water aquifers were included. In addition to operative wells, some of the wells in the survey have never been operated others have been operated, but are now inactive or abandoned. Oilfield brine injection wells are not included, nor are wells exclusively for injection of sewage effluent.

Most of the information contained in the forms has been obtained from the files of state agencies. In some cases, the individual companies have been asked to supply information and have done so. In a few instances, information is from other sources. Each form lists the source or sources from which information was obtained. The wide variation in the quantity and quality of the information in the forms reflects the amount and quality of information readily available. No doubt all or almost all of the items in each form could be filled in, if sufficient time and effort were invested. Although some of the pages contain no information, the complete form has been reproduced for each well, so that additional data can be added if desired.

WELL FILE NUMBER A1-1
UMR

I. Operating Company & General Well Location

Stauffer Chemical Company
Bucks, Alabama
about 16 miles north of Mobile

II. Well location (legal description)

Location: 2056.3 ft. north of the south line, 868.2 ft. east of the west line, SE 1/4, Sec. 7, T.1D., R.1E. Mobile County, Alabama

III. History; system planning, construction & operation.

An initial feasibility study was completed in June, 1968. The well was drilled, completed and tested by February 1969. Surface facilities were completed during April-August, 1969. Injection began in August, 1969. The well is still in operation.

IV. Geology & Geohydrology

A. Regional geologic setting: The well is located on a small anticlinal feature within the Mobile graben on the Gulf Coastal plain of southwest Alabama.

IV. Geology & Geohydrology, continued

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included -yes ___ ; no ___).

(Ground elevation _____) (Total well depth 4,300')

Datum for depth measurement D. F. 41.4 ft.

Name	Age	Depth (top)	Thickness	Lithologic Description
Alluvium			at 40'	---
Miocene			400- 430'	---
Oligocene-Chickasaway Limestone?			1060-1090'	---
Byram Formation? - Bucatunna				
Clay Member?			1150-1180'	1070'
Jackson Group			1270-1300'	---
Moodys Branch Formation			1390-1420'	---
Claiborne Group?			1510-1540'	---

C. Geologic Description of injection units & possible units not in use

Rock Unit Name	Age	Depth (top)	Thickness	Character and Areal Distribution
Wilcox Group	Eocene	2500'		Sands of extensive areal distribution which are each 70 to 80 feet thick.
Midway Group	Paleocene	3880'		

D. Engineering description of injection units

1. Porosity: 34%
2. Permeability: 400 millidarcies
3. Original Reservoir Pressure: 1418 psi - depth not specified
4. Reservoir Temperature: 136°F
5. Chemical Character of Formation Water: Saline
6. Reservoir Fracture Pressure: Fracture gradient found to be 0.82 psi/ft.

(continuation IV - B)

Tallahatta Formation	2080-2110'	1810'?
Wilcox Group?	2500-2530'	---
Hatchetigbee Formation?	3220-3250'	---
Salt Mountain Limestone	3820-3850'	3800'
Midway Group	3850-3910'	3880'

IV. Geology & Geohydrology, continued

E. Geohydrology, fresh water aquifers in vicinity

Name	Depth	Thick. Ness	Character	Chemical Quality
Recent and Miocene sands	0-1,200'	1,200'	unconsolidated sand	potable, used for industrial & municipal supply, yields up to 1,000 gpm

F. Mineral Resources (oil and gas, coal, brines, etc.)

Oil production in the area is from the following fields:

Citronelle field - Rodessa Formation - 10,500 - 11,500'

South Carlton field - Tuscaloosa Formation - 5,800'

Tensaw Lakes field - Paluxy Formation - 8,400'

Salt is produced from the McIntosh salt dome at a depth of about 400'.

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing Weight & Grade	Size	Depth Set	Type & Amount of Cement
Surface	15 "	32.75#/Ft.,H-40,ST&C	10 3/4"	1,238	(1)
Intermed.	9 7/8"	23#/Ft.,J-55,ST&C	7 "	4,216	(2)
Injection		9.3#/Ft.,H-40	4 1/2"	8,401	

(1) 250sks 50-50 Litepoz w/4% gel, 3% CaCl, followed by 225sks 50-50 Litepoz w/4% gel & 3% CaCl, followed by 200sks Class H common w/3% CaCl

Cement (2) 175sks 50-50 Litepoz w/10% gel followed by 300sks Class H

Describe bottom hole completion method: perforation of 7" casing

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: Centralizers for 10 3/4" 1235', 1147', 945', 800', 754', 612', 465'

Centralizers for 7" 4212', 4172', 4131', 4048', 3583

packer Baker model A-1 Lok-set @ 3393'

VI. Description of surface equipment

A. Holding tanks & flow lines Holding tanks before and after filters

B. Filters yes - pressure type

C. Pumps yes - transfer and injection

D. Other

VII. Cores, samples, & logs

A. Coring - Sidewall cores

"	[illegible]	[illegible]	Recovery
"	[illegible]	[illegible]	
"	[illegible]	[illegible]	
"	[illegible]	[illegible]	
"	[illegible]		
"	[illegible]		

B. Drilling Logs

X Drillers Log

X Sample log

X Drilling time

Other:

VII. -- Cores, samples, & logs, continued

C. Other logs run

X Resistivity	___ Gamma ray-neutron
X SP	X Temperature
X Caliper	___ Cement bond
___ Other Compensated density	

VIII. Waste Characteristics

A. Industrial process from which waste is derived
Industrial and agricultural chemical manufacture

B. Physical & chemical Description alkaline wastewater containing small amounts of chlorides and phosporous

C. Volume maximum of 216,000 gpd (140gpm)

IX. Preinjection waste treatment Filtration

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results
Injection		Wilcox sands	420gpm at 500psi well head pressure
		Midway sands	would also accept wastewater, but not as readily as Wilcox zone

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results

C. Injection rates and pressures

1. Rate

Date(s) _____ Average 30 gpm Maximum _____

" _____ " _____ " _____

" _____ " _____ " _____

" _____ " _____ " _____

" _____ " _____ " _____

2. Pressure (well head _____ bottom hole _____)

Date(s) _____ Average 150psi Maximum _____

" _____ " _____ " _____

" _____ " _____ " _____

" _____ " _____ " _____

" _____ " _____ " _____

X. Well operation & operating history

D. Description of operating programs:

E. Operating problems: Will require periodic acid treatment to maintain injection capacity.

XI. Regulatory aspects.

A. Construction requirements

B. Monitoring requirements

C. Restrictions on operating procedure

XII. Economics

A. Total and unit costs of construction

B. Operating costs

XIII. Source(s) of Information and Published References

Alabama Geological Survey

WELL FILE NUMBER _____ STATE A1-2 USR

I. Operating Company & General Well Location

U. S. Steel Corp.
Fairfield Works
Fairfield, Alabama

II. Well location (legal description)

Location: 438.5' E & 279.5S NE Corner, NW 1/4, SW 1/4, Sec. 10, T18S, R4W, Jefferson Couty, Alabama

III. History, system planning, construction & operation.

Drilling began in January, 1970, and the well was completed in March. The well was financed as a research project by U. S. Steel, with the Alabama Geological Survey in charge of all operations. The well is not yet in operation as of June 1972, and it is not certain whether the wastewater will be $FeCl_2$ or $FeSO_4$ when the well is put into operation.

IV. Geology & Geohydrology

A. Regional geologic setting: The well is located in the Valley and Ridge geographic province on the flank of the Birmingham anticline. Limestones, shales, sandstones, chert, dolomite, and some iron ore seams occur, ranging in age from Cambrian to Pennsylvanian at the well site.

IV. Geology & Geohydrology, continued

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included -yes ___; no 1).

(Ground elevation _____) (Total well depth 6000)

Datum for depth measurement _____

Name	Age	Depth (top)	Thickness	Lithologic Description
Pottsville	Pennsylvanian	surf.	3,[illegible]	ss., siltstone, shale & coal
Bangor	Mississippian	3[illegible]	200	limestone, ss. shale
Hartselle	Mississippian	3[illegible]	150	sandstone
Gasper	Mississippian	3[illegible]	3[illegible]	limestone shale
Tuscumbia	Mississippian	3[illegible]	300	limestone
Ft. Payne	Mississippian	3[illegible]	2[illegible]	limestone and cherts
Red Mountain	Silurian	4[illegible]	45	sandstone and limestone
Chickamauga	Ordovician	4[illegible]	2[illegible]	dolomite

C. Geologic description of injection unit & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thickness	Lithologic Description
Copper Ridge (Knox)	Ordovician	4[illegible] (drilled)	2[illegible]	dolomite-partially fractured

Injection zones are at 4,[illegible]4 to 4,[illegible]5 ft. and 5,[illegible]0 to 5,[illegible]0 ft.

D. Engineering description of injection units

1. Porosity: fracture porosity
2. Permeability: fracture permeability
3. Original Reservoir Pressure: _____
4. Reservoir Temperature: _____
5. Chemical Character of Formation Water: [illegible]
6. Reservoir Fracture Pressure: _____

V. Well design and construction: continued

2. Packers, centralizers, well head equipment, etc. Centralizers at 2209, 2265, 2324, 2379, 2431, and 2477 packer placed at 2477

VI. Preservation of aquifer equivalent

A. Method used & from time [illegible] pollution, treatment of wells for abandonment, [illegible]

B. Filters [illegible] Formation Filter[illegible] Filter. Outside filter is fine to coarse sand.

C. Pumps Yes

D. Other

VII. Logs, samples, & tests

A. Drill

From		To		Recovery	
"	2477	"	2519	"	100%
"	2477	"	2519	"	100%
"					
"					
"					

B. Drilling logs

Driller's log

X Sample log

X Drilling time

Pump

VII. -- Cores, samples, & logs, continued

C. Other logs run

X	Resistivity - Injection Laterlog	X	Gamma ray-neutron
X	SP		Temperature
X	Caliper	X	Cement bond
X	Other Sidewall neutron, formation density, fluorescence, radioactive tracer survey		

VIII. Waste Characterization

A. Industrial Process from which waste is derived

B. Physical & chemical description Spent steel pickling liquor. Primarily $FeCl_2$ or $FeSO_4$, dependent on the process that is used.

C. Volume 100 cum

IX. Pre-injection waste treatment Settling, skimming, two stage filtering

X. Well operation & operating history

A. Tests

Type Injection	Duration If hrs.	Zones tested	Description of test results
		Injection well screening Zone 1500ps # 1250ps	
		2810-2975 IHIP 975 FHIP 895 (2hr)	
		3154-3561 IHIP 885 FHIP 885 (3hr	
		3570-3724 test failed	
		3570-3724 IHIP 1492 FHIP 1421 (1hr)	
		4382-4414 IHIP 615 FHIP 615 (4hr)	

B. Treatments or Stimulation

Zones Treated	Treatment Intrvl selected and examined	Description of Treatment and Results
4525-4665		

C. Injection rates and pressures- (well not yet operated, see testing information story)

1. Rate

Date(s) _____ Average _____ Maximum _____

2. Pressure (well head _____ bottom hole _____)

Date(s) _____ Average _____ Maximum _____

I. Well operation & operating history

D. Description of operating program: Not determined, but injection will be continuous during operation of the pre-treatment system, because very little retention of treated wastewater is provided for.

E. Operating problems: Not yet operating, an anticipated possible problem is reaction of the acid wastewater with the caliche of the injection zone to form precipitates of $Fe(OH)_2$, $Fe(OH)_3$, and $CaSO_4$.

II. Regulatory aspects.

A. Construction requirements: as required

B. Monitoring requirements: Monitoring of potability and of fresh water zones. Monitoring of injection rate and pressure and casing-tubing annulus pressure.

C. Restrictions on operating procedure:

III. Facilities

A. Total and unit costs of construction

B. Operating costs

IV. Journals of Information and Relations Libraries
Alumni Relations Survey

WELL FILE NUMBER [illegible] STATE — A1-3 UNR

I. Operating Company & General Well Location

Pelendid Chemical Company
Tuscaloosa, Alabama

II. Well location (legal description)

Northwest 1/4 Sec. 3, T.17S., R.4W., Tuscaloosa County, About 1 mile northeast of the center of Tuscaloosa on U.S. Hwy. 11, Alabama.

III. History, system planning, construction & operation.

Initial feasibility and geological studies were made by the Geological Survey of Alabama and a consulting firm. The results of site study were presented in a report in September 1968. Drilling of the well began in May, 1970, and the well was completed in August 1970. The project was financed by the Federal Water Quality Administration and Pelendid Chemical Co. The project was supervised by the Alabama Industrial Development Board. The well is not in operation [illegible]

IV. Geology & Seismology

A. Regional geologic setting: The site is within the Black Warrior sedimentary basin. Sedimentary rocks at the site range in age from Cambrian to Pennsylvanian.

IV. Geology & Geohydrology, continued

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included--yes ___; no X).

(Ground elevation _____) (Total well depth 8097)

Datum for depth measurement _____

Name	Age	Depth (top)	Thickness	Lithologic Description
Pottsville	Pennsylvanian	80		ss., sh., siltstone
Parkwood	Mississippian	4390		sh. and siltstone
Floyd Shale	Mississippian	4844		sh. and limestone
Ft. Payne Chert		5610		limestone and chert
Chattanooga Shale	Devonian	7835		shale and cherty limestone
Pre- "	Devonian	7870		shale and cherty limestone
undifferentiated	Silurian	8070		limestone
undifferentiated	Ordovician	8134		
Knox Group	Cambrian(?)	8365		dolomitic limestone

C. Geologic description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thickness	Character and Areal Distribution
-	Ordovician	8420	90ft.	sandstone
-	"	8510	200ft.	dolomitic limestone porous zone

D. Engineering description of injection units

1. Porosity: 1.5 to 3.0% in sandstone interval
2. Permeability: _____
3. Original Reservoir Pressure: 3,700 psi from DST at 8,360 - 8,444 ft.
4. Reservoir Temperature: _____
5. Chemical Character of Formation Water: From 6986-7045' Ca-4,400 mg/l, Mg-1,600, Na-25,000, K-1,040, Chloride (Cl)-36,000
6. Reservoir Fracture Pressure: _____

IV. Geology & Geohydrology, continued

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality
	0-	80ft.	limestone and dolomite	fresh
Pottsville	80-3000ft.		sandstones	

F. Mineral Resources (oil and gas, coal, brines, etc.)

Coal beds occur in the Pottsville Formation.

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface	20 in.	H-40 94 #/ft.	16 in	45'	150sks Port.A. & Poz
Intermed.	13 3/4in.	H-40 48 #/ft.	10 3/4in	1220'	500sks lt. cement
	9 5/8in.	K-55 36 #/ft.	7 in	5020'	bottom to 4150ft.
Injection		H-40 6.4#/ft.	2 7/8in	5023'	
Other					

Describe bottom hole completion method: open hole

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: Baker tubing anchor at bottom of tubing string. Centralizers for each casing string.

VI. Description of surface equipment

A. Holding tanks & flow lines

B. Filters

C. Pumps

D. Other

VII. Cores, samples, & Logs

A. Coring

From *8075 to 8097 Recovery 100%

" " "

" " "

" " "

B. Drilling Logs

X Drillers Log

X Sample log

X Drilling time

Other:

*medium-gray dense limestone with thin layers of shale and dolomite.

VII. -- Cores, samples, & logs, continued

C. Other logs run

__X__ Resistivity Laterlog __X__ [illegible]

____SP ____Temperature

____Caliper __X__ Gamma Ray

____Other Sonic, Gamma Ray

VIII. Waste Characteristics

A. Industrial process from which waste is derived

Production of mixed resins, Phenol-Formaldehyde resins, Formaldehyde, herbicides, and DDT waste.

B. Physical & chemical Characteristics Corrosive containing sodium sulfite and sulfate, tarry, salty, mix organic chemicals.

C. Volume 50,000 to 100,000 gpd

IX. Preinjection waste treatment

The Probability Analysis of Fields of various processes and data has been established by following tests. The following are Injection test data through Wells & Tributaries.

Name of Wells	Date of Test	Depth of Injection Tube in Feet	Total Feet	Pressure lbs. Per Sq. Inch	Remarks
A-1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
B-2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
C-3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
D-4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
E-5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
F-6	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
G-7	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
H-8	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
I-9	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results
Drill stem		6936-7465	recovered 6,000 ft. of saline water

See opposite page for injectivity test data.

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results

C. Injection rates and pressures

1. Rate

Date(s) _____ Average _____ Maximum _____

" _____ " _____ " _____

" _____ " _____ " _____

" _____ " _____ " _____

" _____ " _____ " _____

2. Pressure (well head _____ bottom hole _____)

Date(s) _____ Average _____ Maximum _____

" _____ " _____ " _____

" _____ " _____ " _____

" _____ " _____ " _____

" _____ " _____ " _____

X. Well operation & operating history

D. Description of operating programs: _____

E. Operating problems: _____

XI. Regulatory aspects.

A. Construction requirements: _____

B. Monitoring requirements _____

C. Restrictions on operating re[illegible] _____

XII. Economics

A. Total and unit costs of construction

B. Operating costs

XIII. Source(s) of information and published references

Alaska Geological Survey

I. Operator; Company & General Well Location
Diamond-Shamrock Inc.
Painesville, Ohio

II. Well location (legal description)
Location: Sec. 21, T4S, R1W, Rhoderham County, Kansas.

III. History, actual planning, construction & operation.
Initial feasibility studies were made in 1969. The first well was drilled, completed, and tested during the period January 15, 1970, to December 21, 1970. The second well was drilled in June, 1971. The wells are not yet in operation (June 1972).

IV. Geology & Hydrology
A. Regional Geologic Setting. The wells are located within the central Kansas Uplift Plain. The most prominent regional structural features in the area are the Salt Creek Anticline and the Rohrbaugh Rift Zone. Brine penetrates in the wells where it are then pumped to ponds and its saltwater leaves the system.

IV. Geology & Geohydrology, continued 3.

B. Geologic description of rock units penetrated by well:

Rock Unit (Geologic Column Included: -yes ___; no X).

(Ground elevation _____) (Total well depth 7,400ft.)

Datum for depth measurement _____

Time	Age	Depth (top)	Thickness	Lithologic Description
- - -	Oligocene	~1050		
Jackson Group	Eocene	~1230		clay, sand, shale, limestone and marl
Claiborne Group	Eocene	~1440		
Tallahatta Fm.	Eocene	~2160		claystone, shale, and limestone
Wilcox Group	Eocene	~2340		shale, limestone, sandstone, and marl
Midway Group	Eocene	~2460?		marl, limestone, sandstone, and shale
Selma Group	Cretaceous	~4710		chalk
Eutaw Fm.	Cretaceous	~5150		sand, sandstone, and shale
Tuscaloosa Group	Cretaceous	~7200		sand, sandstone and shale

C. Geologic description of injection units & possible units not in use

Rock Unit

Type	Age	Depth (top)	Thickness	Character and Areal Distribution
Wilcox Group	Eocene	2340		sands and sandstones

injection from 1,800 to 3,950

D. Engineering description of injection units

1. Porosity: _____

2. Permeability: _____

3. Original Reservoir Pressure: _____

4. Reservoir Temperature: _____

5. Chemical Character of Formation Water: Saline

6. Reservoir Fracture Pressure: _____

IV. Geology (Lithologic sections)

A. Description, local water aquifers in vicinity

From	Depth to	Thickness	Character	Potential Quality
These water supply is Recent and Tertiary are deposits to a depth of about 600 feet.				

B. Mineral Resources (oil and gas, coal, brines, etc.)

None in the injection unit.

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing, Lining & Grade	Size	Depth Set	Type & Amount of Cement
Surface				1,100	To surface
Intermed.					
Injection					
Liner					

Describe bottom hole completion method: Screen and gravel pack

VII. -- Cores, samples, & logs, continued

C. Other logs run

___Resistivity - induction ___Sonic cement-bond

___SP ___Temperature

___Caliper ___Cement tops

___Other Dipmeter, formation density

VIII. Waste Characteristics

A. Industrial process from which waste is derived

B. Physical & chemical characteristics Brief inclusive data on this formation and formation water including, chlorides, hardness, and pH value

C. Volume estimated to be here from future

IX. Precipitation waste treatment

X. Well operation & operating history

B. Description of operating programs, for example

E. Operating problems

XI. Regulatory aspects

A. Construction requirements

B. Monitoring requirements

C. Reference to operating procedures

WELL FILE NUMBER _____ STATE A1-5 UMR

I. Operating Company & General Well Location

Ciba-Geigy, Inc.

McIntosh, Alabama

II. Well location (legal description)

Location: Sec. 41, T4N, R1W, Washington County, Alabama

III. History, system planning, construction & operation.

Initial feasibility studies were made in 1969. The first well was drilled, completed, and tested during the period October 31, 1970, to December 23, 1970. The second well was completed by June, 1971. The wells are not yet in operation (June 1972).

IV. Geology & Geohydrology

A. Regional geologic setting: See A1-4

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

V. Well design and construction

A. Casing, cementing, well head equipment, etc:

VI. Description of rotary equipment

A. Rotary tools & mud pump

B. Fishing

C. Pumps

D. Other

VII. Cores, Samples, & Logs

A. Coring

From	To	Recovery
"		
"		
"		
"		
"		

B. Drilling logs

____Drillers log

____Sample log

____ Mudding data

____ Other:

VII. -- Cores, samples, & logs, continued

C. Other logs run

___Resistivity - Induction ___Gamma ray-neutron

___SP ___Temperature

_X_Caliper ___Cement bond

___Other formation density

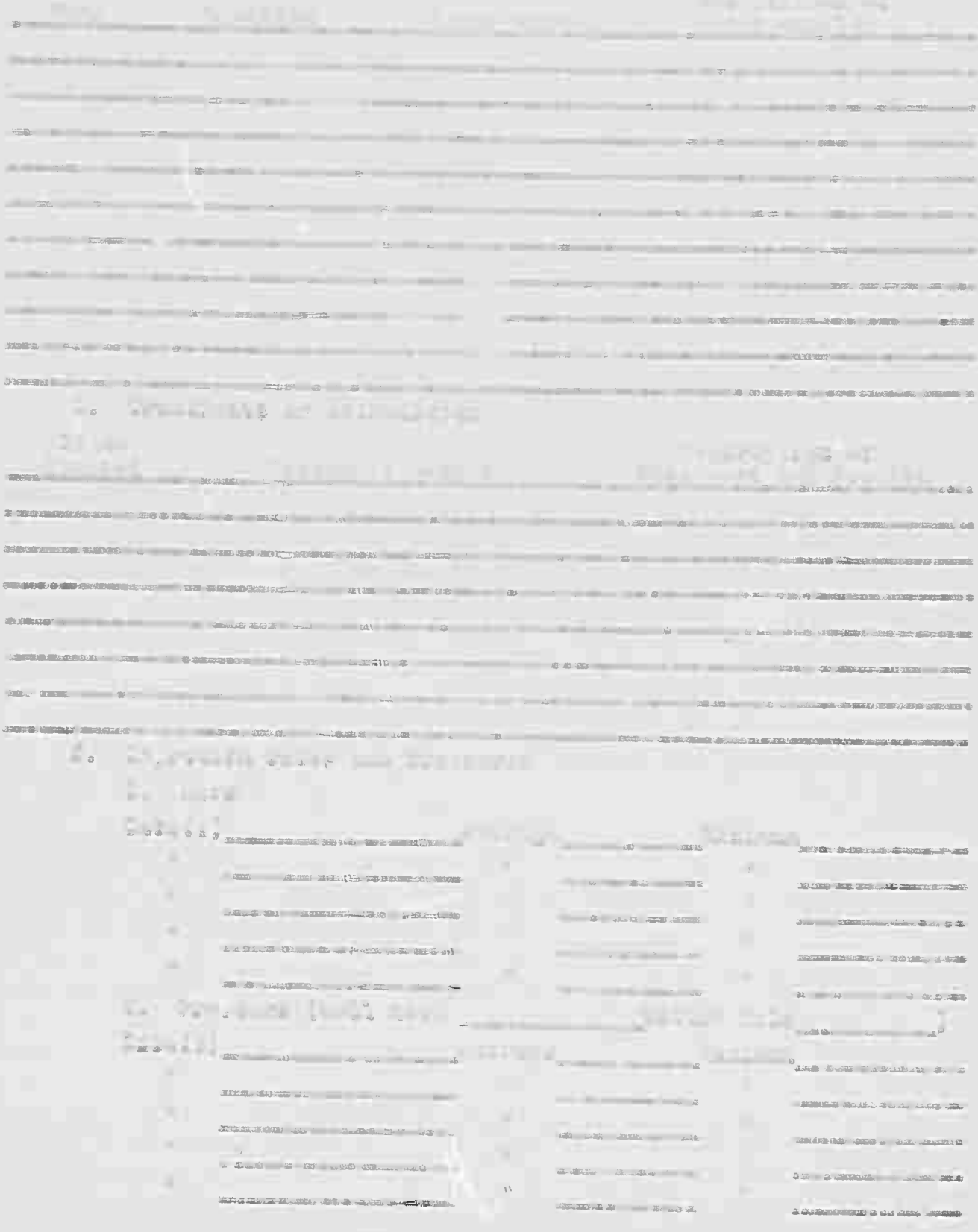
VIII. Waste Characteristics

A. Industrial Process from which waste is derived

B. Physical & chemical Description See #4

C. Volume See #4

IX. Preinjection waste treatment



X. Well operation & operating history

A. Description of operating practices: See Exhibit F

B. Operating problems:

XI. Regulatory aspects.

A. Conservation requirements:

B. Monitoring requirements:

C. Restrictions on operating practices:

WELL FILE NUMBER — STATE — Ca-1 CWF

I. Operating Company & General Well Location

Aerojet General Corporation

Sacramento, California

II. Well location (legal description)

Location: Aerojet General's plant, Sacramento, California.

Sec. 12, T9N, R7E, Sacramento County

III. History, system planning, construction & operation.

The well was drilled and completed in January, 1961 and began operating soon after completion. The well is presently not in use and has been filled with a corrosion inhibitor while it is on standby status.

IV. Geology & Geohydrology

A. Regional geologic setting: The well is located in the southern portion of California's Sacramento Valley. The regional dip at the well site is to the west. The stratigraphic section consists of sands, siltstones, shales of Cretaceous, Tertiary, and Quaternary age.

IV. Geology & Geohydrology, continued

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included--yes ___ ; no X).
(Ground elevation _____) (Total well depth 1964 ft.)
Datum for depth measurement _____

Name	Age	Depth (top)	Thickness	Lithologic Description
The strata encountered in the well consist of a highly variable series of sands, silts, and clays, of Tertiary age. Injection is into sands, that occur between 970 and 1964 feet. Confinement is provided by a sandy siltstone that occurs from 500 to 930 feet.				

C. Geologic description of injection units & possible units not in use

Rock Unit Name	Age	Depth (top)	Thickness	Character and Areal Distribution
	Tertiary	970ft.	994ft.	sands with interbedded siltstone and mudstone

D. Engineering description of injection units

1. Porosity: _____
2. Permeability: _____
3. Original Reservoir Pressure: 400psi at 970ft.
4. Reservoir Temperature: _____
5. Chemical Character of Formation Water: about 300ppm total chlorides and 500ppm total dissolved solids according to an analysis provided by Aerojet General.
6. Reservoir Fracture Pressure: _____

IV. Geology & Geohydrology, continued 3.

E. Geohydrology, fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality
Fresh water occurs in shallow sands				

F. Mineral Resources (oil and gas, coal, brines, etc.)

No mineral resources are reported in the vicinity of the disposal well.

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface			16 "	72ft.	to surface
Intermed.	17"	black steel	12 3/4"	970ft.	to surface
(356sks Permanente Class A + 356sks of perlite + 4% bentonite)					
Injection			8 5/8"	1400ft.	
Injection tubing			2 "	1200ft.	

Other

Describe bottom hole completion method: Slotted 8 5/8in. casing with a gravel pack, with 2in. injection tubing inside the casing.

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: Casing centralizers on 12 1/4 in. casing at 290, 390, 725, and 915 feet. Well scratchers on bottom joint of 12 1/4 in. casing.

VI. Description of surface equipment

A. Holding tanks & flow lines Retention pond

B. Filters yes

C. Pumps Centrifugal pump with a maximum allowable well head injection pressure of ½ psig.

D. Other

VII. Cores, samples, & Logs

A. Coring

From	to	Recovery
-		
-		
-		
-		
-		
-		

B. Drilling Logs

___Drillers Log ___Drilling time

___Sample log ___Other:

VII. -- Cores, samples, & logs, continued

C. Other logs run

___Resistivity ___Gamma ray-neutron

___SP ___Temperature

___Caliper ___Cement bond

___Other ___

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Waste from nitroplasticizer plant.

B. Physical & chemical Description 48,000ppm TDS, 14,500ppm Na, 6,000ppm K, 2,100ppm SO_4, 12,100ppm Cl, 1,000ppm F, 12,000ppm SO_4, 47ppm S, pH 6.7 to 12.2

C. Volume ___

IX. Preinjection waste treatment Settling in a detention pond, filtration, pH adjustment, and addition of corrosion inhibitor.

I. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results
Pressure testing of cement was performed to confirm a satisfactory cementing of the 13 3/4in. casing.			

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results
None reported		

C. Injection rates and pressures

1. Rate

Date(s)	Average 10gpm	Maximum
"	"	"
"	"	"
"	"	"
"	"	"

2. Pressure (well head _____ bottom hole _____)

Date(s)	Average 50psi	Maximum
"	"	"
"	"	"
"	"	"
"	"	"

X. Well operation & operating history

D. Description of operating programs:

E. Operating problems: Increase in injection pressure during later half of 1963 approached the limit specified by the State. This was attributed to corrosion products from the holding tank, the injection tubing, and the 8 3/4 in casing. The entire system was cleaned of corrosion products and put back into operation with corrosion inhibitor added to prevent additional corrosion.

XI. Regulatory aspects.

A. Construction requirements

B. Monitoring requirements

C. Restrictions on operating procedure Maximum bottom hole injection pressure of 500psi.

XII. Economics

A. Total and unit costs of construction

B. Operating costs

XIII. Source(s) of Information and Published References

Written communication: California Water Quality Control Board and the Aerojet General Corporation

I. [illegible]

[illegible]

II. [illegible]

[illegible]

III. [illegible]

[illegible]

IV. [illegible]

A. [illegible]: [illegible]

IV. Geology & Geohydrology, continued

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included--yes___; no X).

(Ground elevation 95ft.) (Total well depth 1110ft. (plugged back to 1070ft.)

Datum for depth measurement K.B. 105 ft.

Name	Age	Depth (top)	Thickness	Lithologic Description
- - -	Cenozoic	0'	396'	interbedded sand and gravel with some silt and clay
- - -	Cenozoic	396'	154'	sand, silt, and clay
	Cenozoic	550'	182'	clay and clayey silt
	Cenozoic	732'	278'	olive gray clay
Wheatland Fm.	Eocene?	1010'	100'	gray fine-grained silty sand
		1110'		volcanic basement rocks

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thickness	Character and Areal Distribution
Wheatland Fm.?	Eocene?	1010'	100'	gray fine-grained silty sand,
	(only 60ft. was left open in the well)			highly variable in lithology, not regionally distributed

D. Engineering description of injection units

1. Porosity: about 35% intergranular
2. Permeability: from less than 100 to 5,000 millidarcies Av. (See below)
3. Original Reservoir Pressure: Not known
4. Reservoir Temperature: Not known
5. Chemical Character of Formation Water: TDS-27,664mg/l, including 14,600mg/l Chloride, 8,400mg/l sodium, 3,000mg/l Sulfate, and 1,600mg/l Calcium, pH 7.6. Analysis of sample from several thousand gallons pumped from one of the test wells.
6. Reservoir Fracture Pressure:

(continuation- D - 2) about 800 md. on one core and 26 Sidewall samples

IV. Geology & Geohydrology, continued 3.

E. Geohydrology, fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality
Fresh water occurs in sands and gravels to a depth of 396 ft. Brackish water is present from 396 to 550 ft. below which the formation water is saline.				

F. Mineral Resources (oil and gas, coal, brines, etc.)

No mineral resources are reported in the vicinity of the disposal well.

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing Weight & grade		Size	Depth Set	Type & Amount of Cement
Surface	17 1/4"	48#/ft.	H-40R-3	13 3/8"	205'	190sks-surface
Intermed.	12 1/4"	32#/ft.	H-40R-3	8 5/8"	980'	450 sacks
Injection						
Other liner		~~96.25 ft. long~~ stainless steel		6 5/8"	1066'	

Describe bottom hole completion method: Liner - perforated, top at 979', bottom at 1070', 60 mesh perforationr, 2" slots, 6" centers, gravel packed

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: 4 1/2" Packer set in the lower joint of the liner at 984' Type - Baker Model AD tension packer set with 10,000 lb. tension.

VI. Description of surface equipment

A. Holding tanks & flow lines An elaborate precipitation treatment system is used to remove silver from the waste-water and to prepare the wastewater for injection.

B. Filters pre-details not known

C. Pumps pre-details not known

D. Other

VII. Cores, samples, & Logs

A. Cores

From 1018 to 1057 Recovery Not known

B. Drilling Logs

X Drillers Log

X Sample log

Drilling time

Other:

VII. -- Cores, samples, & logs, continued

C. Other logs run

X Resistivity - Induction	___ Gamma ray-neutron
X SP	___ Temperature
___ Caliper	X Cement bond
___ Other	

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Photo processing waste

B. Physical & chemical Description Developers, fix solutions, hardeners, bleaches, and wash waters from both color and black and white processes.

C. Volume [illegible] gpd

IX. Preinjection waste treatment Treated to retard bacterial growth with fluoride & at times continual feed, pH maintained at 7.

Silver is removed from the waste by ion exchange with iron.

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results
Water Shut off	1 Hour	open.	confirmed good cement bond
Pumping	10 Hours	Injection zone	could produce 45gpm maximum
Injectivity		Injection zone	100gpm at 750psi well head pressure

B. Treatments or Stimulation

Zones Treated	Treatment Initial	Description of Treatment and Results
Injection zone	Pumped 500 gallons for 10 hours	

C. Injection rates and pressures - See injectivity test data. No operating information obtained.

1. Rate

Date(s)	Average	Maximum

2. Pressure (well head _____ bottom hole _____)

Date(s)	Average	Maximum

X. Well operation & operating history

D. Description of operating programs:

E. Operating problems:

XI. Regulatory aspects

A. Construction requirements

B. Monitoring requirements A cropped water monitor well was constructed to a total depth of 364ft., located 130ft. N and 460ft. West of NE corner, Sec. 5, T15S, R6E

C. Restrictions on operating procedure

XII. Economics

A. Total and unit costs of construction _____

B. Operating costs _____

XIII. Source(s) of information and published references _____

Written communication - Plainfield Quarry and Defense Systems and California Division of Water Quality Control

WELL FILE REPORT

STATE

Ca-1

I. Operating Company & General Well Location

Fairchild Space and Defense Systems, Beale Air Force Base, near Marysville, California

II. Well location (legal description)

Location: 70' South, 275' West of NE corner, Sec. 8, T14N, R4E, Yuba County, California

III. History, system planning, construction & operation.

See Ca-2

IV. Geology & Geohydrology

A. Regional geologic setting: See Ca-2

IV. Geology & Geohydrology, continued 3.

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included yes ___; no X).

(Ground elevation 6171.) (Total well depth 1,101ft.)

Datum for depth measurement K.B. 9ft. (Elevated back to bottom.)

Name	Age	Depth (top)	Thickness	Lithologic Description
	Cenozoic	0	478	Interbedded sand and gravel with some silt & cl
	Cenozoic	478	114	sand, silt, & clay
	Cenozoic	592	290	clay and clayey silt
	Cenozoic	882	248	olive gray clay
Wheatland	Eocene?	1110	150	gray fine-grained silty sand
		1260		volcanic basement rock

C. Geologic Description of injection units & possible units not in use

Rock Unit Name	Age	Depth (top)	Thickness	Character and Areal Distribution
Wheatland Fm.?	Eocene?	1110	150ft.	gray fine-grained silty sand,
		(35' open in well)		highly variable in lithology, not regionally distributed

D. Engineering Description of injection units

1. Porosity: about 5% from 31 tests

2. Permeability: from 1 to 913 millidarcies - see below

3. Original Reservoir Pressure:

4. Reservoir Temperature:

5. Chemical Character of Formation Water: TDS-27,664ppm Sea Ca-2

6. Reservoir Fracture Pressure:

(continuation D - 2) Average about 225 md. from 31 tests.

IV. Geology & Geohydrology, continued

E. Geohydrology, fresh water aquifers in vicinity

Name	Depth	Thick-ness	Character	Chemical Quality
Fresh water occurs in sands and gravels to a depth of 476ft. Brackish water is present from 476 to 590 ft., below which the formation water is saline.				

F. Mineral Resources (oil and gas, coal, brines, etc.)

No mineral resources are reported in the vicinity of the disposal well.

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface	17 1/2"	48#/ft. H-40P-3	13 3/8"	207'	160sks-surface
Intermed.	12 1/4"	32#/ft. H-40R-3	8 5/8"	1096'	530sks-surface
Injection	liner	106.31 ft. long stainless steel	6 5/8"	1191'	

Other

Describe bottom hole completion method: Gravel packed the perforated liner - 90 cu. ft. of gravel. Top at 1096', Bottom at 1196', 60 mesh perforations, 2" slots, 6" centers.

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: 8 5/8 in. Packer set at bottom 10 ft. with 15,000 lb. tension.

VI. Description of surface equipment

A. Holding tanks & flow lines See Ca-2

B. Filters See Ca-2

C. Pumps

D. Other

VII. Cores, samples, & Logs

A. Coring

From	1133 ft.	to 1143 ft.	Recovery
"	1143 ft.	1158 ft.	
"			
"			
"			
"			

B. Drilling Logs

X Drillers Log

X Sample log

Drilling time

Other:

VII. -- Cores, samples, & logs, continued

C. Other logs run

X Resistivity - Induction	___ Gamma ray-neutron
X SP	___ Temperature
___ Caliper	X Cement bond
___ Other	

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Same as Ca-2

B. Physical & chemical Description Same as Ca-2

C. Volume 400,000 gpd

IX. Preinjection waste treatment Same as Ca-2

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results
Water shut off	1 Hour	10[illegible]ft.	[illegible]
Pumping	18 Hours	Injection Zone	[illegible]
Injectivity		Injection Zone	[illegible]

B. Treatments or Stimulation

Zones Treated	Treatment Used	Description of Treatment and Results

C. Injection rates and pressures - No operating data. See injectivity test results

1. Rate

Date(s) _____ Average _____ Maximum _____

2. Pressure (well head _____ Bottom hole _____)

Date(s) _____ Average _____ Maximum _____

4. [redacted]
   b. [redacted]
   f. [redacted]

10. [redacted]
    a. [redacted]
    b. [redacted]
    f. [redacted]

XII. Economics

A. Total and unit costs of construction

B. Operating costs

XIII. Source(s) of Information and Published References

Written communications - Fairchild Space and Defense Systems and California Division of Water Quality Control

WELL FILE NUMBER ~~CA~~ Ca-4
UMR

I. Operating Company & General Well Location

Fairchild Space and Defense System, Beale Air Force Base, near Marysville, California

II. Well location (legal description)

Location: 730' North, 260' West of SE corner, Sec. 5, T14N, R5E, Yuba County, California.

III. History; system planning, construction & operation.

See Ca-2

IV. Geology & Geohydrology

A. Regional geologic setting: See Ca-2

IV. Geology & Geohydrology, continued 2.

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included--yes ___; no X).

(Ground elevation 85 ft.) (Total well depth 1289 ft. (Plugged back to 1213ft.)

Datum for depth measurement K.B. 95ft.

Name	Age	Depth (top)	Thickness	Lithologic Description
	Cenozoic	0	465ft.	interbedded sand and gravel
	Cenozoic	465ft.	135ft.	sand, silt, & clay some silt and clay
	Cenozoic	600ft.	307ft.	clay and clayey silt
	Cenozoic	907ft.	198ft.	olive gray clay
Wheatland Fm.?	Eocene?	1105ft.	178ft.	gray fine-grained silty sand
		1283ft.		volcanic basement rocks

C. Geologic Description of injection units & possible units not in use

Rock Unit Name	Age	Depth (top)	Thickness	Character and Areal Distribution
Wheatland Fm.?	Eocene?	1105ft.	178ft. (108' open in well)	gray fine-grained silty sand, highly variable in lithology, not regionally distributed

D. Engineering description of injection units

1. Porosity: Av. about 32% for 9 samples
2. Permeability: Range from 1 to 3,700 millidareies-See below
3. Original Reservoir Pressure: ___
4. Reservoir Temperature: ___
5. Chemical Character of Formation Water: TDS-27,664ppm See Ca-2
6. Reservoir Fracture Pressure: ___

(continuation D - 2) Av. for 9 tests 560 md.

IV. Geology & Geohydrology, continued

E. Geohydrology, fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality

Fresh water occurs in sands and gravels to a depth of 465 ft. Brackish water is present from 465 to 600 ft., below which the formation water is saline.

F. Mineral Resources (oil and gas, coal, brines, etc.)

No mineral resources are reported in the vicinity of the disposal well.

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing: Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface	17 1/2"		13 3/8"	212'	160sks-surface
Intermed.	12 1/4"		8 5/8"	1095'	360sks
Injection liner		108.47 ft. long stainless steel	6 5/8"	1203'	

Other

Describe bottom hole completion method: Liner-(bottom to top) 20' perforated, 10' semiperforated, 10' blank, 60' perforated, 5' blank, 1' perforated, 5' blank. Gravel pack - 58 cu. ft. of gravel.

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: Baker Model AD tension Packer at 1089.6 ft. with 18,000 lb. tension

VI. Description of surface equipment

A. Holding tanks & flow lines See Ca-2

B. Filters

C. Pumps

D. Other

VII. Cores, samples, & Logs - no core, but 12 sidewall samples

A. Coring

From _____ to _____ Recovery _____

" _____ _____ _____

" _____ _____ _____

" _____ _____ _____

" _____ _____ _____

" _____ _____ _____

B. Drilling Logs

__X__ Drillers Log ____ Drilling time

__X__ Sample log ____ Other: _____

VII. -- Cores, samples, & logs, continued

C. Other logs run

___ Resistivity	___ Gamma ray-neutron
_X_ SP	___ Temperature
___ Caliper	_X_ Cement bond
_X_ Other Induction log	

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Same as Cs-2

B. Physical & chemical Description Same as Cs-2

C. Volume 400,000 gpd

IX. Preinjection waste treatment Treated to retard bacterial growth with Biocide G at 10ppm continual feed.

pH is maintained at 7.

Silver is removed from the waste by ion exchange with iron.

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results
Water shut off		1046ft. and 400ft.	confirmed good cement job
Pumping	8 Hours	Injection zone	Could produce more than 90gpm
Injectivity			Could inject 160gpm at 120 psi well head pressure

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results
Injection	Pumping and surging for 8 hours	

C. Injection rates and pressures - See injectivity test,

1. Rate no operating data obtained.

Date(s)_____ Average_____ Maximum_____

" _____ " _____ " _____

" _____ " _____ " _____

" _____ " _____ " _____

" _____ " _____ " _____

2. Pressure (well head _____ bottom hole_____)

Date(s)_____ Average_____ Maximum_____

" _____ " _____ " _____

" _____ " _____ " _____

" _____ " _____ " _____

" _____ " _____ " _____

X. Well operation & operating history

D. Description of operating programs: _____

E. Operating problems: _____

XI. Regulatory aspects.

A. Construction requirements See Ca-2

B. Monitoring requirements _____

C. Restrictions on operating procedure _____

XII. Economics

A. Total and unit costs of construction

B. Operating costs

XIII. Source(s) of Information and Published References

Written communication - Fairchild Space and Defense Systems

WELL FILE NUMBER STATE Co-1 UMR

I. **Operating Company & General Well Location**

U. S. Corps of Engineers and Chemical Corps
Rocky Mountain Arsenal, Colorado

II. **Well location (legal description)**

Location: NW 1/4, NE 1/4, Sec. 26, T2S, R67W, Adams County, Colorado.

III. **History, system planning, construction & operation.**

The well was drilled and completed in November, 1961 and began disposing of chemical waste from the Rocky Mountain Arsenal into PreCambrian crystalline rock. Prior to the operation of the disposal well, waste was disposed of into seepage ponds on the arsenal grounds. These ponds were responsible for supplying waste which was destroying crops by communication through a shallow aquifer system.

Soon after injection began, the area around the well began experiencing numerous earth tremors which was highly abnormal for this area, since the last quake in the area occurred in 1885.

A statistical correlation between the number of shocks and the injection rate was carried out which postulated that injection could be causing the earth tremors. The operation of the well was suspended in February, 1966 until the correlation could be properly investigated. The well has not operated since it was suspended.

IV. **Geology & Geohydrology**

A. **Regional geologic setting:** The well is situated on the east flank of the Denver Basin, nine miles east of the synclinal axis. The stratigraphic section consists of sandstones, limestones, and shales of Cambrian to Cretaceous age.

IV. Geology & Geohydrology, continued

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included -yes X ; no ___).

(Ground elevation 5170 ft. MSL) (Total well depth 12,045 ft.)

Datum for depth measurement Kelly Bushing

Name	Age	Depth (top)	Thickness	Lithologic Description
Fox Hills	Cretaceous	0ft.	1250ft.	sandstone
Pierre	Cretaceous	1,250ft.	4198ft.	shale
Hygiene	Cretaceous	5,448ft.	2262ft.	sandstone
Niobrara	Cretaceous	7,710ft.	290ft.	chalky shale
Benton	Cretaceous	8,000ft.	345ft.	shale with limestone
Muddy	Cretaceous	8,345ft.	100ft.	sandstone
Dakota	Cretaceous	8,445ft.	300ft.	sandstone

CONTINUED ON NEXT PAGE

C. Geologic Description of injection units & possible units not in use

Rock Unit Name	Age	Depth (top)	Thickness	Character and Areal Distribution
	PreCambrian	11,950ft.		highly fractured hornblende granite gneiss containing pegmatite intrusions

D. Engineering description of injection units

1. Porosity: 2%
2. Permeability: [illegible] $\times 10^{-2}$ md
3. Original Reservoir Pressure: [illegible]psi
4. Reservoir Temperature: [illegible]°F
5. Chemical Character of Formation Water: Brine at 114°C and a density of 1.01gm/cm^3
6. Reservoir Fracture Pressure: .41psi/ft.

IV. Geology & Geohydrology, continued (CONTINUED) 2.

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included -yes____; no____).

(Ground elevation_____) (Total well depth_____)

Datum for depth measurement_____

Name	Age	Depth (top)	Thickness	Lithologic Description
Lakota	Cretaceous	8,700ft.	56ft.	sandstone
Morrison	Jurassic	8,786ft.	190ft.	shale
Lykins	Triassic	8,972ft.	610ft.	sandstone
Fountain	Pennsylvanian	9,772ft.	2100ft.	conglomerate, siltstone & shale
Regolith	Ordovician - Cambrian	11,880ft.	170ft.	
	PreCambrian	11,950ft.		schist & gneiss

C. Geologic Description of injection units & possible units not in use

Rock Unit Name	Age	Depth (top)	Thickness	Character and Areal Distribution

D. Engineering description of injection units

1. Porosity:
2. Permeability:
3. Original reservoir pressure:
4. Reservoir temperature:
5. Chemical character of formation water:
6. Reservoir fracture pressure:

IV. Geology & Geohydrology, continued 3.

E. Geohydrology, fresh water aquifers in vicinity

Name	Depth	Thick. Zone	Character	Chemical Quality
Fox Hills	0	1,250	sandstone and gravel	

F. Mineral resources (oil and gas, coal, uranium, etc.)

Oil is produced from the Tokuse and Minto sandstones in the Minto Field.

V. Well design and drilling data

A. Casing, tubing, and liners

Hole Size	Setting of Casing	Size	Depth Set	Type & Amount of Cement
Surface 12	1/4 in.	10	1/4 in.	Cement + 10 sacks
Intermed. 17 1/2 in.		13 3/8 in.	1,000 ft.	Diatomaceous +
12	1/4 in.	9 5/8 in.	11,000 ft.	Premium Class
Intermediate		5 1/2 in.	5,000 ft.	Pozmix + 10
				Bentonite

Liners

Describe bottom hole completion procedure: Open hole completion

V. Well design and construction, continued

B. Packers, [illegible], well head equipment, etc: _____

Space Model 2 packer at 4125'.

2 centralizers on 8 5/8" casing at 4125', and 5062'.

VI. Description of casing cementing

A. Drilling tanks & flow lines: 4 Tests Flow Line, 10 gate Mobile Lease Tank, 5 [illegible] Concrete pre-fabricated tank, set @ 30'/60 bbl. capacity.

B. Pipes: 2 @ 10 inches Dia. Line Pipes

C. Pumps: 2 @ single stage centrifugal type pumps, 5 Horsepower driven by internal gas; 1 @ portable gasoline water pump

D. Heat: (Special trucks + mobile [illegible]) 2 to drilling batteries

VII. Logs, tests, & logs

A. During

Phase	To	Logging
a.		
b.		
c.		
d.		
e.		

B. Drilling tests

1 Deviation log

Surface 5-10

1 Drilling time

Total: _____

VII. -- Cores, samples, & logs, continued

C. Other logs run

X Resistivity	___Gamma ray-neutron
X SP	___Temperature
___Caliper	___Cement bond

___Other_____

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Chemical waste.

B. Physical & chemical Description Analysis of injection waste is not available, but it described as slightly basic (pH=8.0) and contains ammonia, nitrates, chlorides, chlorates, chlorinated hydrocarbons, and organic phosphorous compounds.

C. Volume 16½ million gal. for life of well.

IX. Preinjection waste treatment Settling, filtration, and addition of bacteria killing agent.

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results
DST	13 tests	Fountain Fm.	7,400ft. of water was recovered. Results were poor.
Pump test		PreCambrian Rocks	Reservoir accepted >400gpm at 2000psi.

B. Treatments or Stimulation

Zones Treated	Treatment Period	Description of Treatment and Results
None		

C. Injection rate and pressure

1. Rate

Date(s) _____ Average 350gpm Maximum 700gpm

" " " "

" " " "

" " " "

" " " "

2. Pressure (well head ____ bottom hole _____)

Date(s) _____ Average 1000psi Maximum 1100psi

" " " "

" " " "

" " " "

" " " "

X. Well operation & operating history

D. Description of operating programs: _____

E. Operating problems: Problem is stated in well history.

XI. Regulatory aspects.

A. Construction requirements _____

B. Monitoring requirements The well was seismically monitored from several locations.

C. Restrictions on operating procedure None reported.

XII. Economics

A. Total and unit costs of construction

B. Operating costs

XIII. Source(s) of Information and Published References

U. S. Army Corps of Engineers, Report of Investigation, "Injection Well Earthquake Relationship - Rocky Mountain Arsenal, Colo.", Oct. 1962.

David M. Evans, "Man Made Earthquakes in Denver", Geotimes, Vol. 10, No. 9, May 1966.

Headden, 1963.

Louis J. Scott, "Pressure Injection Disposal Well, Rocky Mountain Arsenal, Denver, Colo.", The Mountain Geologist, Vol., No. 1, Jan. 1963.

Healy & others, "The Denver Earthquakes", Science, Vol. 161, Sept. 1968.

Healy & Others, "Geophysical & Geological Investigations Relating to Earthquakes in the Denver Area, Colo.", Dept. of Interior, open file report, March 1966.

WELL FILE NUMBER

STATE

Co-2
UMR

I. Operating Company & General Well Location

Shell Oil Company

1700 Broadway

Denver, Colorado 80202

II. Well location (legal description)

250 ft. east and 110 ft. south of west 1/4 corner of sec. 28, T.1 S., R.97 W., Rio Blanco County, Colorado

III. History, system planning, construction & operation.

Injection began January 1, 1971

The well was converted from a stratigraphic test well to a waste disposal well. It is intended for use for 20 months to dispose of approximately 150 acre-feet of waste water from an experimental oil shale project.

The well was originally designed for injection at 1200 ft., but due to low permeability at that depth, it was extended to 1,500 ft. It is presently operating successfully.

The driller was - Signal Drilling Co.

IV. Geology - Stratigraphy

A. Regional Geologic Setting: The well is located on the east flank of the Piceance Creek Basin. The basin contains approximately 4,000 ft. of Tertiary sediments. A COGC bulletin lists a fault 2 1/4 miles from the site. Major drainage in the area is Piceance Creek.

IV. Geology & Geohydrology, continued

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included -yes ___; no X).

(Ground elevation 6,082 ft.) (Total well depth 1500 ft.)

Datum for depth measurement _____

Name	Age	Depth (top)	Thickness	Lithologic Description
Green River Formation	Tertiary	120'	4000'	
Evacuation Creek Member				
Mahogany Member				
Parachute Creek Member				
Garden Gulch Member				
Douglas Creek Member				
Wasatch Fm. Member				

C. Geologic description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thickness	Character and Areal Distribution
Parachute Creek Member of Green River Fm.	Tertiary	1479'	85'	Leached zone

D. Engineering description of injection units

1. Porosity: 20% - by acoustic velocity
2. Permeability: _____
3. Original Reservoir Pressure: about 540 psi in the interval 1370 - 1551 ft.
4. Reservoir Temperature: 77° F
5. Chemical Character of Formation Water: A sodium bicarbonate with a total dissolved solids content of about 22,000 ppm.
6. Reservoir Fracture Pressure: 1566 psi

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thick-ness	Character	Chemical Quality
The only information states that ground water is found in the Green River Formation. Information related to ground-water can be found in "Geohydrology of the Piceance Creek Structural Basin between the White and Colorado Rivers, Colorado" by Coffin, et. al.				

F. Mineral Resources (oil and gas, coal, brines, etc.)

Extensive petroleum deposits are found in the basin in the form of oil shale. Sodium minerals such as dawsonite [NaAl(OH)$_2$CO$_3$] and nahcolite [NaHCO$_3$] are found in the lower portion of the Parachute Creek Member.

T. Well Design and Construction (See attached diagram)

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing Weight & Grade	Size	Depth Set	Type & Amount of Cement & Additives
Surface	12 1/4"		9 5/8"	193'	425 sacks =Class G
Intermed.	8 3/4"	K-55 36lb/ft.	7"	1100'	730 sacks = Dowell Lite
Injection	6"	9.5 lb/ft	3 1/2"	1100'	
Producer	6 1/4"	9.5 lb/ft	3 1/2"		
			3 1/2" bottom	170'	

Other

Describe bottom hole completion method: Open hole completion to 1742 ft. Slotted 3 1/2 inch casing at the bottom 30 ft. of hole.

V. Well design and construction, continued 4.

B. Packers, centralizers, well head equipment, etc:

Tension packer at 1,090 ft. Baker lock set packer at 1,127 ft.
A pressure gauge is used in the well head.

VI. Description of surface equipment (See attached diagram)

A. Holding tanks & flow lines 100 barrel surge tank and 7,500 barrel lined sump pit.

B. Filters

C. Pumps

D. Other

VII. Cores, samples, & logs

A. Cores

From ____ to ____ Recovery ____

B. Drilling bars

___ Drillers log ___ Drilling time

___ Simple log ___ Other: ____

VII. -- Cores, samples, & logs, continued

C. Other logs run

___ Resistivity	X Gamma ray-neutron
X SP	___ Temperature
___ Caliper	___ Cement bond
X Other Dual Induction - Laterolog, sonic log	

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Waste from an experimental oil shale pilot project.

B. Physical & chemical Description Brine solution with up to 150,000 ppm of dissolved solids containing sodium carbonate and bicarbonate as the principal salts.

C. Volume +100 gpm

IX. Preinjection waste treatment Settling of suspended solids and possible filtration and dilution if necessary.

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results
Drill stem #1		1111'-1242'	Pressure-fluid at 1111'
Drill stem #2		1270'-1500'	Pressure-fluid at 1253'
Injectivity tests		Isolated zone	Injection zone
(at least 5)		at 1447'-1481'	140 gal./min. at a well-head pressure of 1000#

B. Treatments or stimulation

Zones Treated	Treatment (type)	Description of treatment and results

C. Injection rates and pressures

1. Rate

Date(s) Jan. 6, 1971 Average 42 gpm Maximum

Feb. 1971 42 gpm 42 gpm

2. Pressure (well head _____ bottom hole _____)

Date(s) Jan. 6, 1971 Average 198 psi Maximum

Feb. 1971 210 psi

X. Well operation & operating history

D. Description of operating programs: _____

E. Operating problems: _____

XI. Regulatory aspects.

A. Conservation requirements _____

B. Participating agreements: _____

C. Possibility of unitization or communitization _____

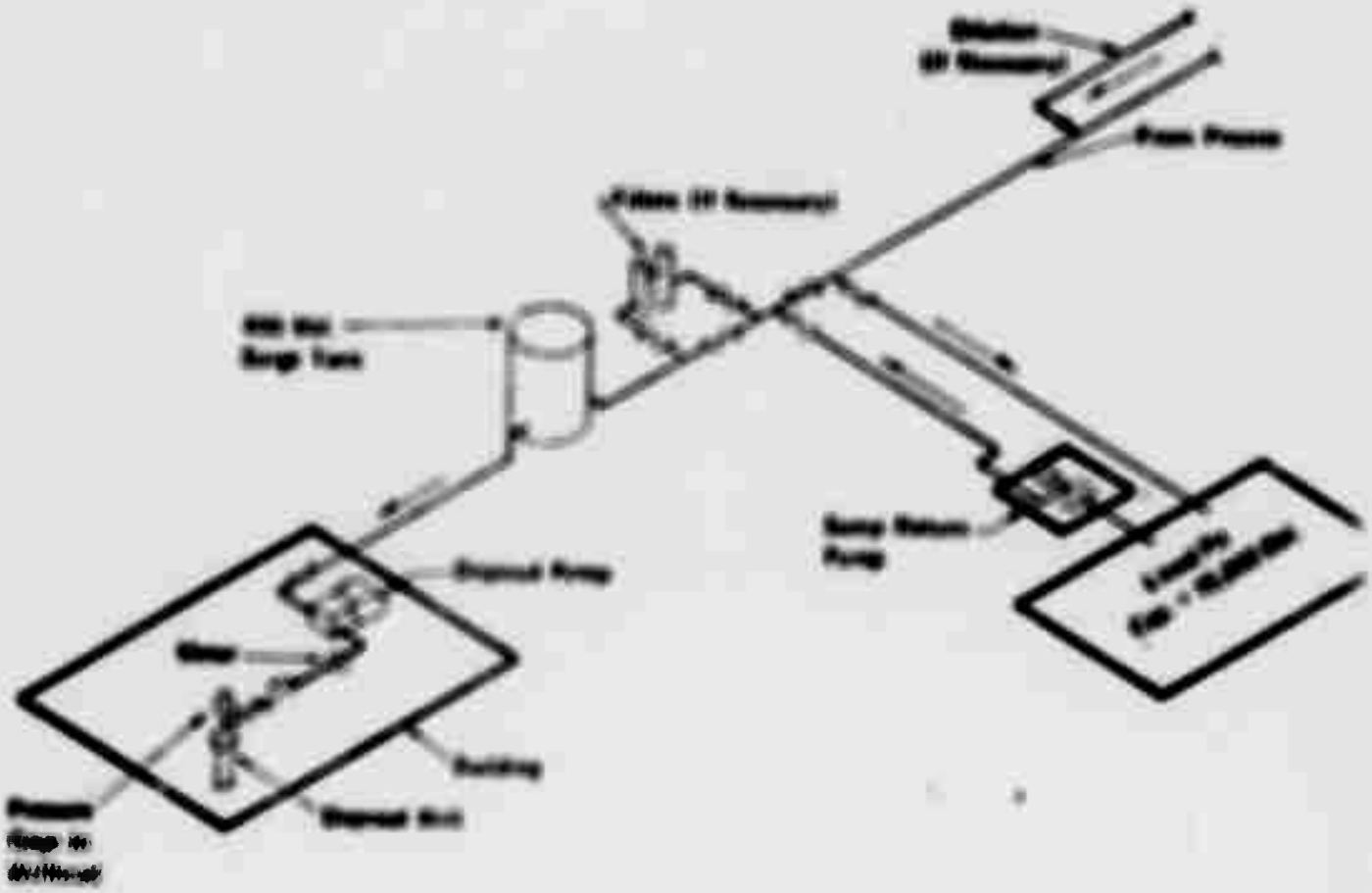
VII. Remarks

A. Total 4 unit cost of construction

B. Operating costs

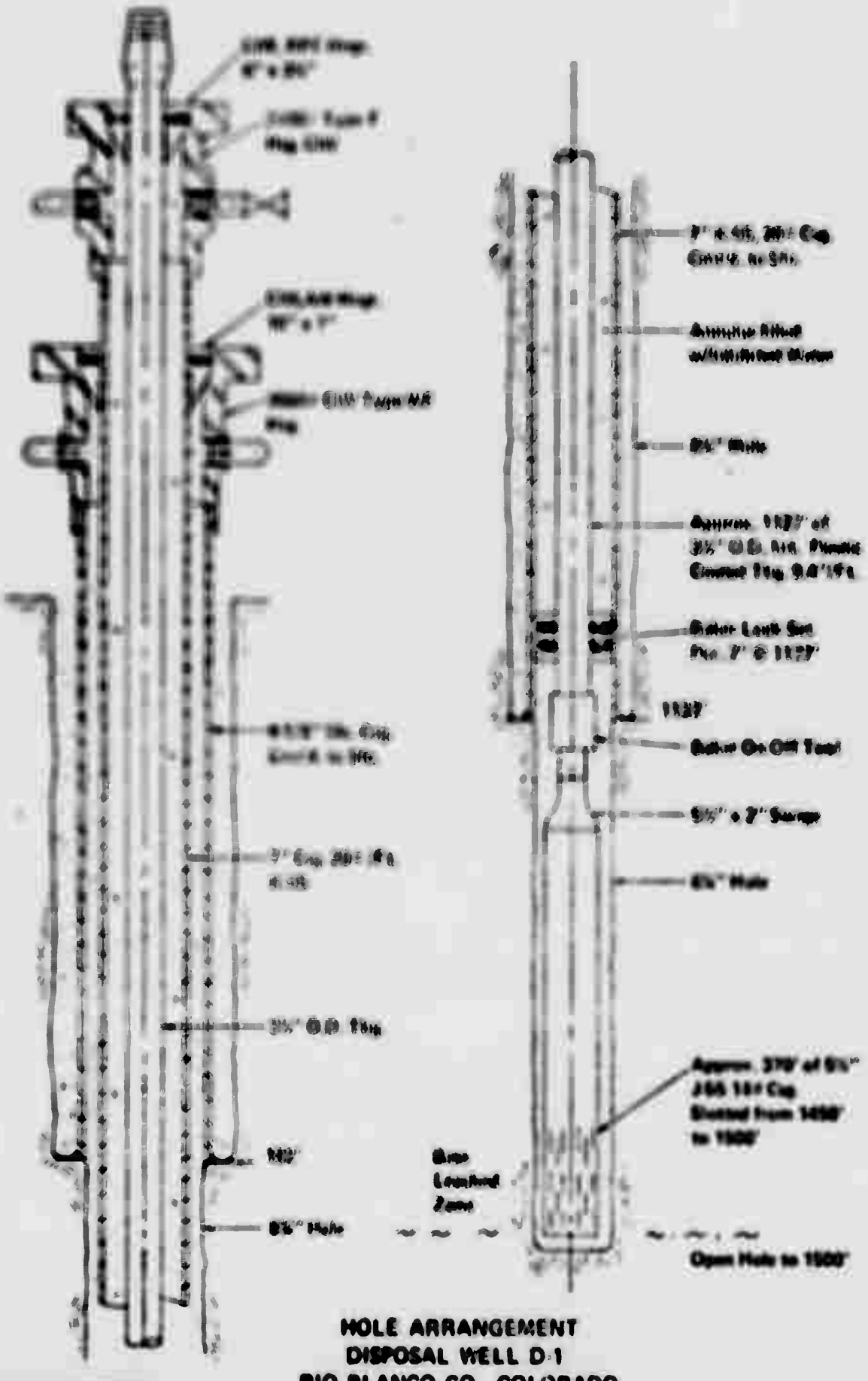
VIII. Source(s) of information and Published References

Written communication - Colorado Water Pollution Control Commission



DISPOSAL SYSTEM
RIO BLANCO CO., COLORADO

Revised Fig. 1
of Exhibit "C"



HOLE ARRANGEMENT
DISPOSAL WELL D-1
RIO BLANCO CO., COLORADO

Reproduced from best available copy.

Supplement to Figs. 2 of Exhibit "C"

WATER POLLUTION CONTROL COMMISSION

OF THE STATE OF COLORADO

APPLICATION OF SHELL OIL COMPANY TO OPERATE A SUBSURFACE DISPOSAL SYSTEM UPON AND UNDER A TRACT OF LAND IN THE NW¼ SW¼ OF SECTION 28 AND THE NE¼ SE¼ OF SECTION 29, TOWNSHIP 1 SOUTH, RANGE 97 WEST, RIO BLANCO COUNTY, COLORADO, AND TO CONVERT A STRATIGRAPHIC TEST WELL TO A DISPOSAL WELL.	PERMIT FOR SUBSURFACE DISPOSAL

1. The Colorado Water Pollution Control Commission has found that disposal as proposed in the application by Shell Oil Company could take place within the intended meaning of Section 3, subsection (b), paragraph (4) of the Rules and Regulations for Subsurface Disposal Systems.

2. The Commission hereby grants Shell Oil Company a permit for the operation of a subsurface disposal system as provided for in Section 3, subsection (d) of the Rules and Regulations of Subsurface Disposal Systems, subject to the following conditions and stipulations:

   a) Permit is granted for a period of thirty (30) months, effective December 1, 1970.
   b) Total volume is not to exceed 150 acre feet.
   c) Pump pressure is not to exceed 350 pounds per square inch.
   d) Injection interval is to be from 1133 feet to 1500 feet.
   e) Daily records are to be submitted monthly in duplicate to the Division of Administration showing rate of injection, volume of fluid, pump pressure, casing pressure (on inert fluid), chemical character of waste and/or any other reasonable information required. Report forms to be furnished by the Division of Administration.

   f) Samples of waste are to be analyzed weekly, unless waived by Division of Administration, or whenever a significant change in chemical quality is anticipated by the operator. Analysis is to be performed by the applicant's laboratory or an approved independent laboratory and the results of analysis certified.

   g) Employees of Department of Health and Department of Natural Resources are to be allowed access to the disposal site without prior notification for purposes of observation of disposal operation and sample collection of waste being injected.

   h) All evaporation pits, settling basins, and holding ponds are to be lined with an impermeable membrane.

1) Permit is not to be assigned nor operations contracted to another party without prior approval of the Commission.

3. Monitoring to be conducted by Shell Oil Company is to be as follows:

a) The disposal well shall be shut down and a pressure fall off test performed periodically. (Ten day intervals initially and until further notice.) Shut down period is to be as long as necessary to obtain conclusive results. Data and/or charts are to be submitted to Division of Administration within five days of completion of test.

b) Chemical quality records (by laboratory analysis) from Shell's domestic water well are to be submitted monthly to monitor quality of water in the alluvium. If analysis are performed more frequently, this data will also be submitted.

c) Three river sampling stations on Piceance Creek will be activated and maintained by Shell Oil Company. Locations to be as follows:

1) Approximately one mile upstream from disposal site to measure quality and flow.

2) Approximately one-half mile downstream from disposal site to measure quality.

3) Near the confluence of Piceance Creek with the White River to measure quality and flow.

Laboratory analysis on quality measurements from river sampling stations to be submitted monthly.

d) Additional monitoring procedures and installations as may be required upon subsequent review by the Commission.

4. All other requirements as adopted by the Commission in the Rules and Regulations for Subsurface Disposal shall be observed by Shell Oil Company.

BY ORDER OF THE COLORADO WATER POLLUTION CONTROL COMMISSION

Frank J. Rozich

Frank J. Rozich, P.E., Technical Secretary

WELL FILE NUMBER

I. Operating Company & General Well Location
Consolidated Cement Company, Division of Fonolite Company
Pensacola, Florida

II. Well location (legal description)
Location 31° 21' N., 87° 13' W. - Well No. 1
Escambia County

III. History, system planning, construction & operation.
Plant operation began in 1953. By 1962 waste volumes had tripled. Problems with the bio-oxidation system caused examination of other methods. Because of favorable geologic circumstances, subsurface injection was selected. A rotary - cable tool rig was selected for drilling, and the well was drilled to T.D. of 1,808 ft. (surf. elev. + 36 ft.). Injection began in July 1963. Injection rate averaged 600 gpm, but increased to 1,200 gpm in 1965. A second well was then constructed in 1964.

IV. Geology & Geohydrology

A. Regional geologic setting: The well is located on the Coastal Plain of Florida. The sedimentary beds dip gently toward the southwest (See attached cross section, Fig. 1).

2. Geologic description of rock units penetrated by well:
Rock Unit (Geologic failure included--yes ___ : no___).
(Ground elevation_____) (Total well depth_____)
Datum for depth measurements _____

Name	Age	Depth (top)	Thick-ness	Character and Areal Distribution

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thick-ness	Character and Areal Distribution
lower limestone of the Floridan Aquifer - Oscalla Group	Tertiary		359'	Nearly pure limestone 97% $CaCO_3$ with wide areal distribution.

D. Engineering description of injection units

1. Porosity: unknown, but increased continuously by the acidic waste
2. Permeability: Original transmissivity about 6,500gpd/ft. Storage coefficient 2 x 10^{-4}
3. Original Reservoir Pressure: 76 feet above sea level 17 psi
4. Reservoir Temperature: _____
5. Chemical Character of Formation Water: See table 1
6. Reservoir Fracture Pressure: Unknown

IV. Geology (Lithology, Permeability, Porosity)

B. Hydrology, fresh water aquifers in vicinity

Name	Depth	Thick.	Description	Chemical Quality
	0'-40'	40'	sand and gravel	Fresh water
	-270'	90'	sand	usually suitable for drinking water
				slightly saline water (less than 1,000
Aquifer	-370'	225'	limestone	

V. Mineral resources (oil and gas, coal, brines, etc.)

V. Well design and construction (See Figure 2)

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing. Weight & Grade	Size	Depth Set	Type & Amount of Cement
Surface					
Intermed.					
Injection	Casing liner is stainless steel.				
Other					

Describe bottom hole completion method:

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: A teflon packer was installed, but failed to seal initially. It was later installed. Since there was no packer at first, inhibited diesel oil was kept in the casing-tubing annulus. Later, the packer was repaired and installed with corrosion inhibited water in the annulus. A pump is used to circulate inhibited water around the annulus.

VI. Description of surface equipment

A. Holding tanks & flow lines Holding pond

B. Filters None

C. Pumps Horizontal two-stage centrifugal constructed of 304 stainless steel and driven by a 350 hp. electric motor. Pump capacity 1,200 gpm at 400 psi.

D. Other

VII. Cores, samples, & Logs

A. Coring

From_____ to_____ Recovery_____

" _____ _____ _____

" _____ _____ _____

" _____ _____ _____

" _____ _____ _____

" _____ _____ _____

B. Drilling Logs

_X_ Drillers Log

_X_ Sample log

____ Drilling time

____ Other: _____

VII. -- Cores, samples, & logs, continued

C. Other logs run - no logs run

___Resistivity ___Gamma ray-neutron

___SP ___Temperature

___Caliper ___Cement tops

___Other

VIII. Waste characteristics

A. Industrial process from which waste is derived

Manufacture of major products from raw materials, including intermediates such as nitric acid and tetraethylenediamine, and secondary chemicals required for the process.

B. Physical & chemical Description

Organic and inorganic acids, nitric acid, ammonia, adiponitrile, hexamethylenediamine, sodium hydroxide, sodium carbonate bicarbonate, and ketones. See table for other waste properties.

C. Volume About 300 ppm in 1963 increased to 2000 ppm in 1971

IX. Preinjection waste treatment Because precipitates result when alkaline and acid waste streams are mixed, the combined waste is aged and the precipitates allowed to settle in waste ponds. A pH of less than 5.0 is maintained in the final waste to maintain and increase the permeability of the injection horizon.

Flow in c.f.m.	[illegible]
Chemical oxygen demand, ppm	3,[illegible]-12,000
Turbidity, ppm	[illegible]
Settleable solids (24 hr.), ppm	5-52
Particle size of settleable solids, microns	0.5-45
pH	2.2-8.9
Reactions with formation brine at pH of 8.0	Heavy magnesium precipitate
Reactions with formation brine at pH of 5.0	No precipitate
Bacterial count (final pond), colonies/cu. cm.	50
Bacterial count (composited waste), colonies/cu. cm.	0-8
Reaction alkaline waste with acid waste	Heavy precipitate
Sand filtration reduced turbidity, ppm	0.6-1.5

E. Well operational & workover history

a. Data

Date	Operation	Depth Interval	Description of Results
[illegible]	[illegible]	1,210-1,220	165 Psig treating pressure
	Injection	1,197-1,220	1000 gpm injected at 350 psi

b. Treatments or Stimulation

Date	Material Used	Description of Treatment and Results
[illegible]	[illegible]	[illegible]

c. Injection rates and pressures

1. Rate

Date(s) _____ initial Average 880 mpm Maximum 1,100 mpm

" _____ Average 600 mpm up to' 1965.

" _____ " the present average

" _____ " (1971) is about

" _____ " 1000 mpm "

2. Pressure (well head X bottom hole)

Date(s) _____ initial Average 149 psi Maximum 165 psi

" _____ " " "

" _____ " " "

" _____ " " "

" _____ " " "

X. Well operation & operating history

A. Description of operating program:

B. Operating problems: Failure of liner under a rock fillup, which plugged the tube. A new sealing diameter packer liner was installed with a packer.

XI. Regulatory aspects.

A. Construction requirements

B. Monitoring requirements: Monitor wells were constructed. A shallow well was constructed 100 feet from the injection well to monitor the upper limestone. A monitor well was constructed 1,300 feet south of the injection well to monitor the lower limestone. The deep monitor wells were drilled one 2 miles north and one 1 1/2 miles south of injection well. Pressures in the monitor wells are continuously recorded and monthly water samples are collected.

C. Restrictions on operating procedure

XXI. Incidents

A. Total and date state of emergency under [illegible]

B. Governing event [illegible]

XXII. Source(s) of Information and Published References





B. Geologic description of rock units penetrated by well
(Are fresh water aquifers underlain by salty water? yes ____; no X).
(Depth to base of deepest fresh water aquifer: 1,350') (Total well depth: 1,750')
Datum for depth measurements: _____

Name	Age	Depth (top)	Thickness	Lithologic Description
See F-1				

C. Geologic Description of injection units & possible units not in use

Rock Units

Name	Age	Depth (top)	Thickness	Character and Areal Distribution
Lower Floridan	Tertiary	1,400'	350'	

D. Engineering description of injection units

1. Porosity: See F-1
2. Permeability: See F-1
3. Original Reservoir Pressure: See F-1
4. Reservoir Temperature: _____
5. Chemical Character of Formation Water: See F-1
6. Reservoir Fracture Pressure: Unknown

IV. Geology & Geohydrology, continued

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality
See F-1				

F. Mineral Resources (oil and gas, coal, brines, etc.)

None present in the area

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing: Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface			12"	1,400'	
Intermed.					
Injection					
Other					

Describe bottom hole completion method: Open hole

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: _____

VI. Description of surface equipment

A. Holding tanks & flow lines _____

B. Filters _____

C. Pumps _____

D. Other _____

VII. Cores, samples, & Logs

A. Coring

From _____ to _____ Recovery _____

" _____ _____ _____

" _____ _____ _____

" _____ _____ _____

" _____ _____ _____

" _____ _____ _____

B. Drilling Logs

___ Drillers Log ___ Drilling time

___ Sample log ___ Other: _____

VII. -- Cores, samples, & logs, continued

C. Other logs run

____Resistivity ____Gamma ray-neutron

____SP ____Temperature

____Caliper ____Cement bond

____Other

VIII. Waste Characteristics

A. Industrial Process from which waste is derived
See F-1

B. Physical & chemical Description See F-1

C. Volume See F-1

IX. Predisjection waste treatment See F-1

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results

C. Injection rates and pressures

1. Rate

Date(s)	Average	Maximum
"	"	"
"	"	"
"	"	"
"	"	"

2. Pressure (well head _____ bottom hole _____)

Date(s)	Average	Maximum
"	"	"
"	"	"
"	"	"
"	"	"

XII. Economics

A. Total and unit costs of construction _____

B. Operating costs _____

XIII. Source(s) of Information and Published References _____

Florida Bureau of Geology

U. S. Geological Survey

WELL FILE NUMBER _____ STATE P-3 USR

I. Operating Company & General Well Location

Sugar Cane Growers Cooperative of Florida
Belle Glade, Florida
Quaker Oats Co.-Belle Galde Chemical Plant is well operator
Well is on Quaker Oats Company property.

II. Well location (legal description)

Location: Sec. 28, T43S, R37E - Well No. 1
Palm Beach Co.

III. History; system planning, construction & operation.

A report concerning the feasibility of subsurface waste disposal at the Sugar Cane Growers Cooperative furfural plant was prepared by a consulting engineering firm and submitted to the Quaker Oats Company in June, 1965. Specifications for the well were contained in a report dated July, 1965. Drilling of the test well began August 12, 1965, and stopped December 10, 1965, at a depth of 1,705 feet. Shortly thereafter, the well was deepened to 1,939 feet. In 1971, the well was deepened again to 2,242 feet. Injection zone was originally 1,496 to 1,938. It is now 1,940 to 2,240 feet. Operated from Dec. 1966 through July 1971, when the well was shut down for the season. From October 1971 to mid January 1972 injection was into well number 2. Injection resumed in January 1972, but in a deeper interval.

IV. Geology & Geohydrology

A. Regional geologic setting: The well is located in the Florida Peninsula portion of the Gulf Coastal Plain. Limestones, marls, and some clays of Cretaceous to Miocene age occur in the subsurface. Disposal is into permeable limestones of Eocene to Oligocene age that dip gently southward.

IV. Geology & Geohydrology, continued 2.

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included--yes X ; no).

(Ground elevation 11.3') (Total well depth 2,242')

Datum for depth measurement

Name	Age	Depth (top)	Thick-ness	Lithologic Description
See geologic column attached to F-4				

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thick-ness	Character and Areal Distribution
Lake City Formation	M.Eocene	1,496-1,940	original	widely distributed throughout all of Florida and parts of Alabama, Georgia, and South Carolina
Lower permeable zone of the Floridan aquifer		1,940-2,240	now	

D. Engineering description of injection units

1. Porosity: very porous
2. Permeability: very permeable
3. Original Reservoir Pressure: 18 psi above ground
4. Reservoir Temperature: 85°
5. Chemical Character of Formation Water: Chloride content in excess of 7000 ppm at 1,940 feet.
6. Reservoir Fracture Pressure: Unknown

IV. Geology & Geohydrology, continued

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality
Biscayne	0-200'	200'	fresh	

Fresh water occurs only in the shallow Biscayne aquifer to a depth of about 200 feet. The upper zone of the Floridan aquifer at 1,045 to 1,105 feet contains water with a chloride of 1,160 mg/l.

F. Mineral Resources (oil and gas, coal, brines, etc.)

Groundwater is the only known resource.

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing. Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface			20"	228	300sks Type I
Intermed.			16"	684	400sks Type I
			12"	1,492(2)	850sks Type (1)
Injection - liner		ss 316 sch. 40	8"	1,938	cemented in 1,500 to 1,938' interval

(1) 300sks Type I followed by 500sks Type II and 20sks G-8

Other (2) bottom 16 feet stainless steel 316 MLC

Describe bottom hole completion method: Open hole

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: Liner hanger and teflon seal at 1,482 ft.

VI. Description of surface equipment

A. Holding tanks & flow lines Surge tank for holding of wastewater after screening.

B. Filters 500 micron screen for removal of large suspended particles in sugar house wastewater.

C. Pumps

D. Other

VII. Cores, samples, & Logs

A. Coring-no coring

From_____ to_____ Recovery_____

"_____ _____ _____

"_____ _____ _____

"_____ _____ _____

"_____ _____ _____

"_____ _____ _____

B. Drilling Logs

X Drillers Log ___ Drilling time

X Sample log at 5' intervals ___ Other:

VII. -- Cores, samples, & logs, continued

C. Other logs run

X Resistivity	X Gamma ray-neutron
____ SP	X Temperature - on deepened well
X Caliper	____ Cement bond
____ Other	

VIII. Waste Characteristics

A. Industrial Process from which waste is derived Manufacture of furfural from sugar cane bagasse and sugar cane processing.

B. Physical & chemical Description Stripping column effluent, which is essentially a dilute acetic acid solution, containing minor amounts of other dissolved organic chemicals and 200 ppm of insoluble fibres, pH 2.3, BOD 10,000 mg/l, and temperature 210°F. A wastewater stream from the sugar plant also injected.

C. Volume About 1 million gpd with approximately 200,000 gpd from the sugar plant and 800,000 gpd from the furfural plant.

IX. Preinjection waste treatment Filtration of sugar house wastewater

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results
Injection	25 hours	1,500-1,705'	610mm @ 1[illegible]
			550mm @ 7[illegible]

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results

C. Injection rates and pressures

1. Rate

Date(s) Overall Average 400-800mm Maximum

" Jan. 15, 1972 " 700mm "

2. Pressure (well head bottom hole)

Date(s) Overall Average 40-50psi Maximum

" Jan. 15, 1972 " 28psi "

Well operates from approximately October or November to May or June.

V. Well operation & operating history

D. Description of operating procedure: The well operates from approximately January or November to May or June each year.

E. Operating problems: An increase of BOD and TOC was noted in the two monitor wells, in the stationary zone of the Pleistocene aquifer during the fall of 1969. As a result, it was decided to pursue the well and cease it off to a depth of 1,200 feet to prevent upward migration of the injected wastewater. The well was shut down from July 1971 to January 1972 for this work.

VI. Regulatory aspects.

A. Construction requirements as constructed

B. Monitoring requirements 1. Continuous monitoring of wastewater flow. 2. Continuous recording of wastewater temperature & injection pressure. 3. Daily and weekly analysis of wastewater. BOD, TOC, pH, and suspended solids are used as weekly indicator parameters.

C. Recommendations on operating procedure see below

wastewater stream. 4. Construction of shallow and deep monitor wells. Conductivity is measured on daily grab samples and COD and pH on weekly grab samples from the monitor wells.

XII. Economics

A. Total and unit costs of construction

B. Operating costs

XIII. Source(s) of Information and Published References

Florida Bureau of Geology

U. S. Geological Survey

Garcia-Bengochea and Vernon, 1970

Vernon, 1970

WELL FILE NUMBER _____ STATE F-4 UMR

I. Operating Company & General Well Location

Sugar Can Growers Cooperative (well owners)
Belle Glade, Florida
Quaker Oats.-Belle Glade Chemical plant is well operator.
Well is on Quaker Oats Co. property.

II. Well location (legal description)

Location: Sec. 28, T46S, R37E, Palm Beach County
about 75 feet from well number 1.

III. History, system planning, construction & operation.

Deep monitor well drilled in 1966 operated as a monitor well from 1966 to 1971 used for injection October 1971 to January 1972, now in use as a monitor well and standby injection well.

IV. Geology & Geohydrology

A. Regional geologic setting: The well is located in the Florida Peninsula portion of the Gulf Coastal Plain. Limestones, marts, and some clays of Cretaceous to Miocene age occur in the subsurface. Disposal is into permeable limestones of Eocene to Oligocene age that dip gently southward.

IV. Geology & Geohydrology, continued

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included--yes X ; no ___).

(Ground elevation ± 15ft.) (Total well depth 2,067ft.)

Datum for depth measurement Ground level

Name	Age	Depth (top)	Thickness	Lithologic Description
See attached geologic column				

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thickness	Character and Areal Distribution
Lower permeable zone of the Floridan aquifer	Eocene and Oligocene	1,610	300'	widely distributed throughout all of Florida and parts of Alabama, Georgia, and South Carolina

D. Engineering description of injection units

1. Porosity: very porous
2. Permeability: very permeable
3. Original Reservoir Pressure: 16 psig above hydrostatic or about 720 psi total at 1600 feet.
4. Reservoir Temperature: 85°
5. Chemical Character of Formation Water: Chloride content in excess of about 1,000 mg/l up to 7,000 mg/l
6. Reservoir Fracture Pressure: Unknown

IV. Geology & Geohydrology, continued

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality

Fresh water occurs only in the shallow Biscayne aquifer to a depth of about 200 feet. The upper zone of the Floridan aquifer at 1,045 to 1,105 feet contains water with a chloride content of 1,160 mg/l.

F. Mineral Resources (oil and gas, coal, brines, etc.)

No resources other than fresh water in the immediate area.

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing. Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface		black steel	20"	240	
Intermed.		black steel	16"	848	
0-1474 black steel, 1474-1490 SS316ELC			12"	1490	
Injection		through tubing			
Other					

Describe bottom hole completion method: Open hole

1490 - 1840 12" hole, 1840 - 2067 9" hole

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: _____

VI. Description of surface equipment

A. Holding tanks & flow lines _____

B. Filters _____

C. Pumps _____

D. Other _____

VII. Cores, samples, & Logs

A. Coring

From _____ to _____ Recovery _____

" _____ _____ _____

" _____ _____ _____

" _____ _____ _____

" _____ _____ _____

" _____ _____ _____

B. Drilling Logs

__X__ Drillers Log

__X__ Sample log

____ Drilling time

____ Other: _____

VII. -- Cores, samples, & logs, continued

C. Other logs run

X Resistivity	___ Gamma ray-neutron
___ SP	___ Temperature
X Caliper	___ Cement bond

___ Other _____

VIII. Waste Characteristics

A. Industrial Process from which waste is derived Manufacture of furfural from sugar cane bagasse and sugar cane processing.

B. Physical & chemical Description Stripping column effluent, which is essentially a dilute acetic acid solution, containing minor amounts of other dissolved organic chemicals and 200 ppm of insoluble fibres, pH 2.3, BOD 10,000 mg/l. and temperature 210°F. A wastewater stream from the sugar plant is also injected.

C. Volume _____

IX. Preinjection waste treatment Filtration of sugar house wastewater

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results

C. Injection rates and pressures

1. Rate

Date(s) *Jan. 12, 1972 Average ~700gpm Maximum _____

" _____ " _____ " _____

" _____ " _____ " _____

" _____ " _____ " _____

" _____ " _____ " _____

2. Pressure (well head _____ bottom hole _____)

Date(s) *Jan. 12, 1972 Average 55psi Maximum _____

" _____ " _____ " _____

" _____ " _____ " _____

" _____ " _____ " _____

" _____ " _____ " _____

last date of operation as an injection well

X. Well operation & operating history

D. Description of operating programs: Used only as a standby well at the present time.

E. Operating problems: None

XI. Regulatory aspects.

A. Construction requirements

B. Monitoring requirements See P-3

C. Restrictions on operating procedure

XII. Economics

A. Total and unit costs of construction

B. Operating costs

XIII. Source(s) of Information and Published References

Florida Bureau of Geology

U. S. Geological Survey

Garcia-Bengochea and Vernon, 1970

Vernon, 1970

SUGAR CANE GROWERS CO-OP No.2 DISPOSAL WELL
CLASSIFICATION
MICCENE
EOCENE and OLIGOCENE
AQUIFER
AQUICLUDE
AQUIFER
AQUICLUDE
AQUIFER
CASING
FLOW
CALIPER

WELL FILE NUMBER ~~STATE~~ P-5 ~~CWR~~

I. Operating Company & General Well Location

E. I. DuPont de Nemours and Co.

Starke, Florida

II. Well location (legal description)

Location: Sec. 17, T.8S., R.4E., Clay County

III. History, system planning, construction & operation.

Drilling permit issued in March 1963. Well drilled in April - August, 1963, and plugged January 19, 1965, without being used for injection.

Well plugged Jan. 19, 1965, from 1,940 to 2,140 feet with cement and top 20 feet of casing plugged with cement.

IV. Geology & Geohydrology

A. Regional geologic setting:

IV. Geology & Geohydrology, continued

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included--yes____; no____).

(Ground elevation_____) (Total well depth_____)

Datum for depth measurement_____

Name	Age	Depth (top)	Thickness	Lithologic Description
----	early Ordovician ?	3,400-3,500		quartz sandstone - micaceous shale

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thickness	Character and Areal Distribution
No satisfactory injection units encountered				

D. Engineering description of injection units

1. Porosity:_____
2. Permeability:_____
3. Original Reservoir Pressure:_____
4. Reservoir Temperature:_____
5. Chemical Character of Formation Water:_____

1,877' - <700 mg/l NaCl Equivalent

2,036' - 16,500 mg/l NaCl Equivalent

6. Reservoir Fracture Pressure:_____

IV. Geology & Geohydrology, continued

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thick-ness	Character	Chemical Quality

F. Mineral Resources (oil and gas, coal, brines, etc.)

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing. Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface		78#	24 "	300	
Intermed.		78# J-55	16 "	1,990	
		47# J-55	11 3/4"	2,040	
Injection 10 5/8"					
Other					

Describe bottom hole completion method:

VII. -- Cores, samples, & logs, continued

C. Other logs run

___Resistivity	___Gamma ray-neutron
___SP	___Temperature
_X_Caliper	___Cement bond
___Other Sonic	

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Phosphate mine and mill

B. Physical & chemical Description

C. Volume

IX. Preinjection waste treatment

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results
DST	23'	2028'	Formation pressure ~800 psi

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results

C. Injection rates and pressures

1. Rate

Date(s)	Average	Maximum
"	"	"
"	"	"
"	"	"
"	"	"

2. Pressure (well head _____ bottom hole _____)

Date(s)	Average	Maximum
"	"	"
"	"	"
"	"	"
"	"	"

X. Well operation & operating history

D. Description of operating programs:

E. Operating problems:

XI. Regulatory aspects.

A. Construction requirements

B. Monitoring requirements

C. Restrictions on operating procedure

XII. Economics

A. Total and unit costs of construction

B. Operating costs

XIII. Source(s) of Information and Published References

Florida Bureau of Geology

WELL FILE NUMBER 1965-EA-106 (STATE) I1-1 (UMR)

I. Operating Company & General Well Location

Velsicol Chemical Corporation
Marshall, Illinois

II. Well location (legal description)

Location: Well No. 1
615' S and 750' W of the NE corner, SW 1/4, Sec. 12, T11N, R12W, Clark County.

III. History; system planning, construction & operation.

In January, 1965, Velsicol Chemical Corporation wrote to the Sanitary Water Board, documenting their intention to construct a well for injection of a sodium hypochlorite brine. Design documents for the injection system were submitted with the letter. A permit was issued March 5, 1965, by the Sanitary Water Board to construct the well subject to the following restrictions:

(a) As-built plan documents will submitted by Velsicol Chemical Corp. to this Board upon completion of the construction of the facilities including surface works of pumps, piping and waste receiving sump etc., deep well head structure and curbing, deep well log, casing record and all development activity records in preparing well to receive wastes;

(b) Also, that particular precautions will be taken to place the saran lined casing in the well without critical damage to the saran lining;

(over)

IV. Geology & Geohydrology

A. Regional geologic setting: At the well site, Paleozoic rocks dip gently southward into the Illinois basin. The well is located in a broad syncline, about 13 miles east of the LaSalle anticlinal belt.

(c) Also, that the well hole will be plugged in the event it cannot be completed or used now or/ it is abandoned in the future and said plugging precedures will be in accordance with the specific approval of the State Sanitary Water Board and the Department of Mines and Minerals;

(d) Also, monthly operation records be submitted to this Board indicating the volumes of material injected, type and approximate composition of waste materials injected, operational injection pressures and other data essential to operation of the deep well disposal facilities.

Drilling began March 29, 1965, and was completed April 11, 1965, at a total depth of 2,636 feet. About 30 to 35 feet of drilling tools were lost in the hole, blocking it off about 100 feet from the bottom. The tools could not be retrieved, and injection tests were made with the tools in the hole. Injection tests were successful, and fresh water was injected for a few weeks to create a barrier between the formation water and the wastewater.

Injection of about 50gpm of wastewater began in November, 1965. Injection was by gravity flow and no pump was required.

A feasibility report for a second well was submitted by Velsicol July 9, 1971. Additional information was submitted July 30, 1971.

The Illinois EPA agreed to drilling of the test well August 18, 1971 subject to the following conditions:

(1) Final engineering plans be submitted after completion of the well to review and approve prior to waste injection.

(2) Computations of underground storage area and rate of waste travel be provided.

(3) If modification of test well drilling procedure are necessary, the Epa be notified prior to making such changes is projected to Devonian at 2,500'.

IV. Geology & Geohydrology, continued 2.

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included--yes X ; no ___).

(Ground elevation 627') (Total well depth 2636')

Datum for depth measurement Kelly Bushing 632'

Name	Age	Depth (top)	Thickness	Lithologic Description
See geologic column				

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thickness	Character and Areal Distribution
----	Devonian	2372	200-300'	Cherty dolomitic limestone-
			264' penetrated in well	widely distributed through Illinois and surrounding sta
*Salem	Mississippian	1534	237'	dense oolitic limestone

*planned for disposal, but not used

D. Engineering description of injection units

1. Porosity:
2. Permeability:
3. Original Reservoir Pressure: 1006psi at 2382' to 2636'
4. Reservoir Temperature:
5. Chemical Character of Formation Water: 14,000ppm dissolved solids
6. Reservoir Fracture Pressure:

IV. Geology & Geohydrology, continued

F. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality
As far as could be determined, all water wells in the vicinity (10 mi. radius) were located in glacial drift although some penetrated a few feet into bedrock. Most are 100 feet or less in depth. The Pennsylvanian rocks are fairly impermeable and the ground water is highly mineralized below a depth of a few hundred feet. Dissolved solids in the ground water: 4500ppm at 150 feet, 7,000ppm at 321 feet, 10,000ppm at 505 feet.				

F. Mineral Resources (oil and gas, coal, brines, etc.)

Numerous oil wells are located in the vicinity of the well. Oil and gas producing zones are within 4 miles of the well. The depth ranges from 400 feet in the Westfield East Pool to 2700 feet in the Martinsburg pool. A gas-producing zone is situated about 1.5 miles east of the well at a depth of 2030 feet. Some stratigraphic pay zones are Pennsylvanian sandstone, Trenton limestone, Carper sandstone, and Devonian limestone. Many of the dry wells are later used as brine injection wells.

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing. Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface	12 1/4"	28 API	8 5/8"OD	417'	to surface
Intermed.	7 3/8"	Saran lined Steel	14 1/2"OD	2390'	to surface
Injection	through 4 1/2" casing				
Other	4 1/2" OD aluminum casing from 1530 to 1756				

Describe bottom hole completion method: open hole

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: _____

VI. Description of surface equipment

A. Holding tanks & flow lines See figure

B. Filters None

C. Pumps None

D. Other _____

VII. Cores, samples, & logs

A. Coring

From _____ to _____ Recovery _____

"

"

"

"

"

B. Drilling Logs

X Drillers Log

X Sample log

X Drilling time

Other: final construction report

VII. -- Cores, samples, & logs, continued

C. Other logs run

X Resistivity-induction	___Gamma ray-neutron
___SP	___Temperature
___Caliper	___Cement bond
X Other Scale log	

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

B. Physical & chemical Description The waste is a spent hypochlorite process liquor with the following approximate chemical analysis: sodium chloride 140,000ppm, sodium hydroxide 25,000ppm, sodium hypochlorite 20,000ppm. Temperature 135°F, pH 10.5-11.5, Specific gravity 1.15

C. Volume about 50,000 gallons/day

IX. Preinjection waste treatment Setting of dissolved solids and pH adjustment

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results
Drill stem	48'	Salem 1501-1810	Formation pressure 574psi
	38'	Devonian 2352-2636	" " 1006psi

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results
2390-2600	acidized	

C. Injection rates and pressures

1. Rate

Date(s)	Average	Maximum
" week of 1/06/67	" 92 gpm	"
" " " 6/07/68	" 30 gpm	"
" " " 8/29/69	" 33 gpm	"
"	"	"

2. Pressure (well head X bottom hole)

Date(s)	Average	Maximum
" week of 1/06/67	" 28"mercury	"
" " " 6/07/68	" 24" "	"
" " " 8/29/69	" 0	"
"	"	"

X. Well operation & operating history

D. Description of operating programs: injection is generally continuous

E. Operating problems: Equipment was lost in the bottom 34 feet of the hole during construction and was never recovered. The well periodically plugs with carbonate precipitate, and is acidized to restore permeability.

XI. Regulatory aspects.

A. Construction requirements See permit documents

B. Monitoring requirements

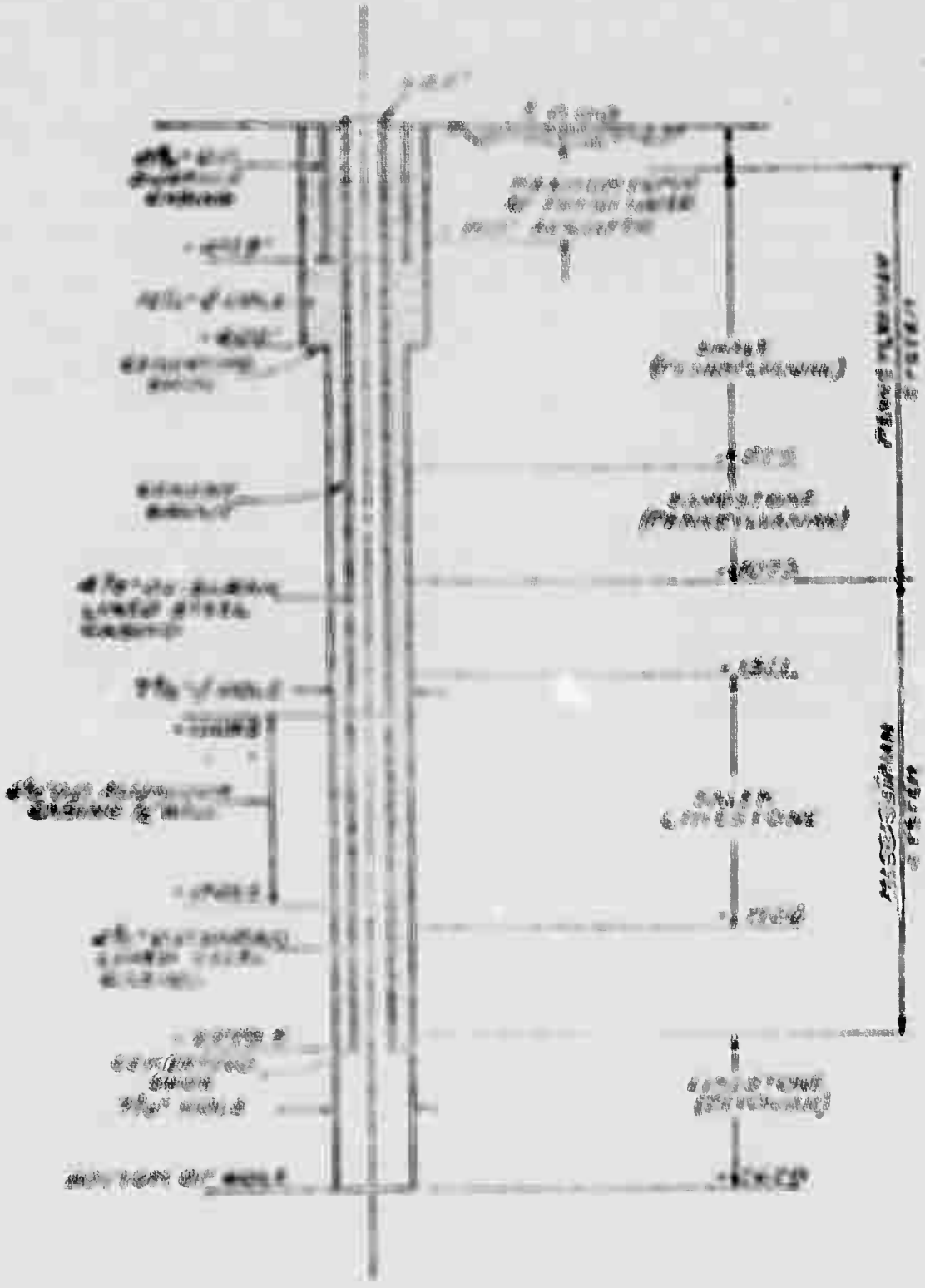
C. Restrictions on operating procedure

XII. Economics

A. Total and unit costs of construction

B. Operating costs

III. Source(s) of Information and Published References



ILLINOIS
CHEMICAL CORP
WELL
LOG OF WELL

WELL FILE NUMBER No. 1966-EA-32 (STATE) II-2 (UMR)

I. **Operating Company & General Well Location**

Cabot Corporation
P. O. Box 188
Tuscola, Illinois
Plant is about 3 miles west of Tuscola, Illinois.

II. **Well location (legal description)**

Location: 1745" North and 800" of the SE corner, SE 1/4, SW 1/4, SE 1/4, T16N, R8E, 3rd principal meridian, Douglas County.

III. **History, system planning, construction & operation.**

Application for a drilling permit was filed with Division of Oil and Gas November 3, 1965. Permit No. 231 was issued March 10, 1966. Application for a permit to construct a waste treatment work was filed with the Sanitary Water Board December 1, 1965. A Permit No. 1 66-EA-32 was issued January 20, 1966, to construct and operate the injection system. The permit specified that a final construction report would be submitted, and that any changes from the original plan would be reported. A letter dated April 11, 1966, from Cabot Corp. to the Illinois Sanitary Water Board reported that the well had been drilled to the St. Peter Sandstone, which was found to be unsuitable for disposal and stating Cabot Corporation's plan to deepen the hole and examine the Trempealeau Dolomite at 5,100 ft., the Galesville Sandstone at 5,600 ft. and the Mt. Simon Sandstone at 6,400 ft.

A letter dated April 26, 1966, from the Cabot Corp. to the Sanitary Water Board reported the results of drilling the hole to 5,318 ft. and completing it for disposal into the (Over)

IV. **Geology & Geohydrology**

A. **Regional Geologic setting:** The well is located in the Illinois synclinal basin on the west flank of the LaSalle anticlinal belt. The regional dip is about 40 feet per mile toward the south. The Tuscola anticline crests a few miles east of the well.

Trempealeau and Franconia Formations from 4,898' to 5318 ft.

The well was apparently put into operation during late 1966. A letter dated August 16, 1967 from the Sanitary Water Board to Cabot Corporation requested a monthly report of system operation inclunding the quantity of wastewater injected, any indication of change in the injection pressure, and character or injected wastewater.

In May 1960, Cabot Corporation requested permission to inject 200 - 400 gpm of sodium chloride solution separated from the waste efflunet from production of organically treated bentonite into the annulus between the injection tubing and the casing of the existing injection well.

Formal application for a Permit to inject the chloride wastewater was applied for by Cabot Corporation April 30, 1969. In the application, permission was also requested to inject the filtrate from the wastes produced by the Staley Starch Company. At the request of the Sanitary Water Board, Cabot Corporation supplied further information.

A letter dated September 17, 1970, from Cabot Corporation to the Illinois Environmental Protection Agency requested that Cabot be allowed to inject an etching waste produced by the R. R. Donnelley Company.

Illinois EPA Permit 1971-EB-29 was issued January 11, 1971, granting permission to Cabot Corporation to inject 150 gpm into the existing well, including the four wastewaters mentioned. Conditions of the permit are the standard eight conditions of all permits and the additional conditions that the Agency be notified of any changes in operation or in materials injected and any modifications in surface disposal facilities, or well maintenance program.

IV. Geology & Geohydrology, continued

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included--yes ___; no X).

(Ground elevation 689.56) (Total well depth 5,318)

Datum for depth measurement Ground Level

Name	Age	Depth (top)	Thickness	Lithologic Description
	Mississippian	1,330		
	Devonian	2,466		
	Silurian	2,602		
Maquoqketa Sh.	Ordovician	3,148		
Trenton Ls.	Ordovician	3,360		
St. Peter ss.	Ordovician	4,006		
Eminence	Cambrian	4,809	150-200	
Potosi	Cambrian	---	250-300	

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thickness	Character and Areal Distribution
Eminence	Dolomite-Cambrian	4892	---	sandy dolomite
Potosi	Dolomite-Cambrian	----	---	limestone and dolomite

The total injection interval is 426 feet from 4,892 feet to 5,318 feet in the two formations, which are widely distributed throughout the north central states.

D. Engineering description of injection units

1. Porosity:

2. Permeability: very high

3. Original Reservoir Pressure: 2,035 psi @ 4,861 feet

4. Reservoir Temperature:

5. Chemical Character of Formation Water: Estimated to be greater than 20,000ppm dissolved solids, based on swab samples.

6. Reservoir Fracture Pressure:

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality

Most water wells in this area are in the glacial drift and are relatively shallow, usually less than 300 feet.

The city of Tuscola municipal well No. 5 penetrates the Devonian and terminates in the Silurian at a depth of 552 feet. The entire column is essentially dolomite, with some limestone and chert in the Devonian. The aquifer was not identified by the driller, but was probably fissured Silurian Dolomite.

F. Mineral Resources (oil and gas, coal, brines, etc.)

The Tuscola Anticlinal is an oil producing structure, with production starting in 1962. The pay zone is the Kimmswick (Trenton). Oil shows are present in Pennsylvanian, Devonian, and Silurian Groups.

Coal is mined near Newman, west of the area. The coal beds are in the Pennsylvanian.

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing: Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface	12 1/4"	24# seamless steel	8 5/8"	816	to surface
Intermed.	7 7/8"	14# J-55	5 1/2"	4600	1050sks Pozmix to
		Fiberglass	4 1/2"	4898	surface
Injection		Fiberglass	2 "	4867	680 gal. resin

Other Fibercast casing is attached to bottom of 5 1/2" steel casing.

Describe bottom hole completion method: open hole

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: The annulus is filled with diesel oil, no packer is used.

VI. Description of surface equipment

A. Holding tanks & flow lines See attached line diagram for original design. The present design is included in a report submitted by Cabot Corp. April 1969. All piping is pvc or fiberglass.

B. Filters

C. Pumps Teflon body Vanton pump with Harell rubber internal parts.

D. Other

VII. Cores, samples, & Logs

A. Coring

From _____ to _____ Recovery _____

" _____ _____ _____

" _____ _____ _____

" _____ _____ _____

" _____ _____ _____

" _____ _____ _____

B. Drilling Logs

__X__ Drillers Log

__X__ Sample log

__X__ Drilling time-geolograph

____ Other: _____

VII. -- Cores, samples, & logs, continued

C. Other logs run

X Resistivity - Induction	___ Gamma ray-neutron
___ SP	___ Temperature
___ Caliper	___ Cement bond

___ Other Fm. density

VIII. Waste Characteristics

A. Industrial Process from which waste is derived Manufacture of Cab-O-Sil, a finely divided silicon dioxide used for various industrial purposes.

B. Physical & chemical Description Hydrochloric acid (33%) with a specifice gravity of 1.16, and a trace of suspended silicon dioxide. The HCl was originally sold, but loss of the market forced implementation of a disposal program.

C. Volume 35,000 gal. per day as of Dec. 1965

IX. Preinjection waste treatment Portions of the various waste-waters are settled and filtered.

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results
Injectivity	8.5 hours at 280gpm		pressure increased 11 psi in 8.5 hours and returned to normal 6 minutes after shut-in.

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results

C. Injection rates and pressures *

1. Rate

Date(s) _____ Average 107,000 gal/month Maximum 75 gpm

" _____ " _____ " _____

" _____ " _____ " _____

" _____ " _____ " _____

" _____ " _____ " _____

2. Pressure (well head _____ bottom hole _____)

Date(s) _____ Average _____ Maximum _____

" _____ " _____ " _____

" _____ " _____ " _____

" _____ " _____ " _____

" _____ " _____ " _____

*Operating reports contain only monthly tonages of acid and starch filtrate. No volume or pressure data are included.

X. Well operation & operating history

D. Description of operating programs: Not known

E. Operating problems: None reported.

XI. Regulatory aspects.

A. Construction requirements System required to be constructed as specified in application for permit, or specific request made for any changes.

B. Monitoring requirements Measurement of injected volumes, injection pressure, and chemistry of injected wastewater.

C. Restrictions on operating procedure EPA must be notified of any changes in facilities, procedures, or waste chemistry.

XII. Economics

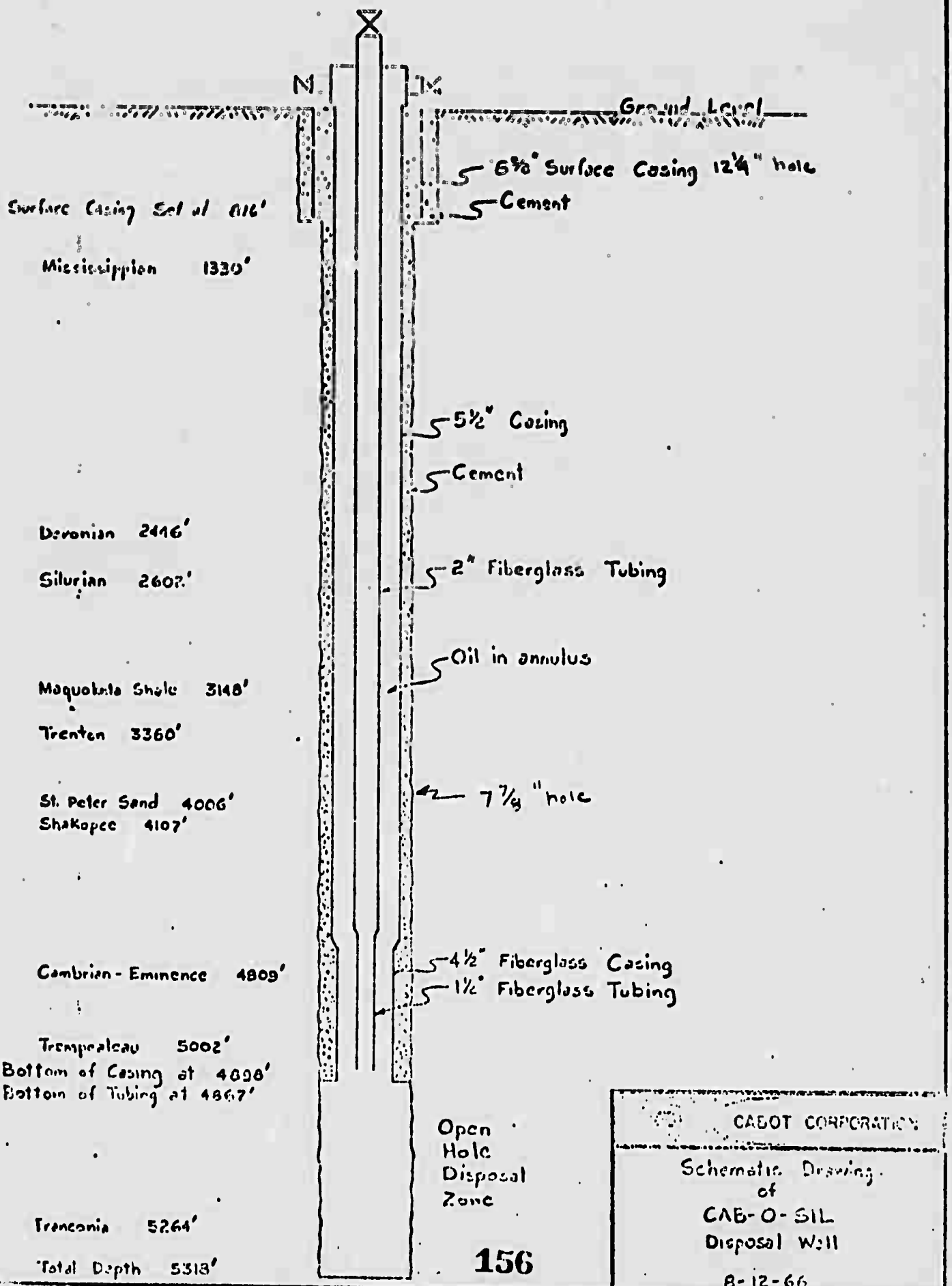
A. Total and unit costs of construction

B. Operating costs

XIII. Source(s) of Information and Published References

Illinois Environmental Protection Agency

Illinois Geological Survey

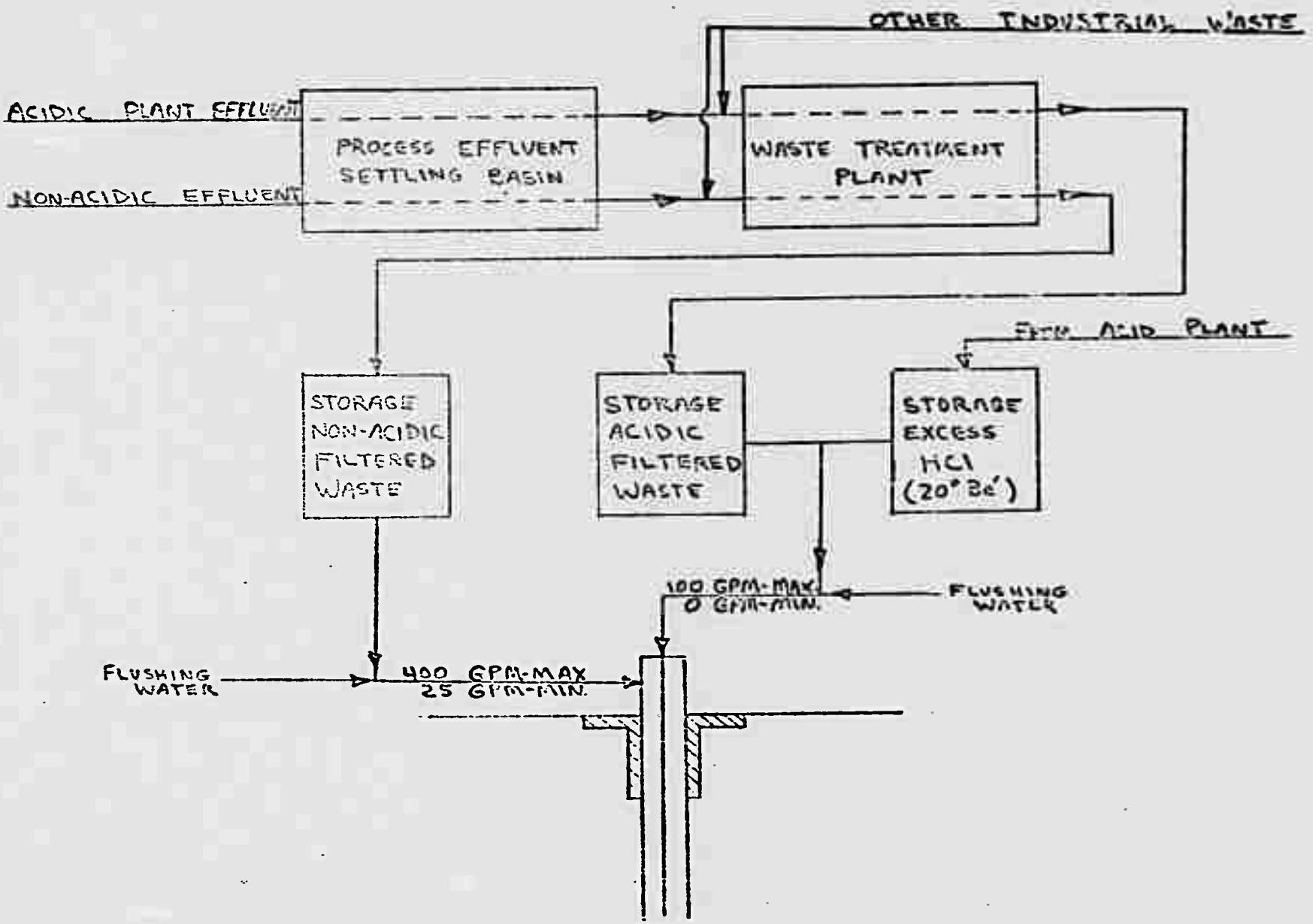


CABOT CORPORATION

Schematic Drawing of CAB-O-SIL Disposal Well

8-12-66

CABOT CORPORATION DISPOSAL WELL
TUSCOLA, ILL.



WELL FILE NUMBER | Permit No. 1966-EA-321 STATE | I1-3 UMR

I. **Operating Company & General Well Location**

Jones and Laughlin Steel Company
Hennepin, Illinois

II. **Well location (legal description)**

Locations: 390" north and 190.8' west of the SE corner of the SW 1/4, SW 1/4, Section 3, T32N, R2W, Putnam County.

III. **History, system planning, construction & operation.**

A feasibility report was submitted by Jones and Laughlin Steel Company to the Illinois Sanitary Water Board in early 1966. The report was reviewed by the Board, and the Illinois Geological Survey, and a permit (No. 1966-EA-321) to construct and use the well was issued June 9.

Drilling permit No. 683 was issued June 1, 1966, by the Illinois Department of Mines and Minerals.

Drilling of the well began July 1, 1966 and was completed August 12, at a total depth of 4,868 ft.

In compliance with the specifications of the permit, the well completion data was submitted by Jones and Laughlin to the Sanitary Water Board in August, 1967.

The well was placed in operation in December, 1967, and is still in operation.

IV. Geology & Geohydrology

A. **Regional geologic setting:** The well is located in the northern portion of the Illinois synclinal basin west of the LaSalle anticlinal belt. The beds in the area dip dently toward to southeast.

IV. Geology & Geohydrology, continued

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included -yes X ; no ___).

(Ground elevation _____) (Total well depth 4,846)

Datum for depth measurement Ground Surface

Name	Age	Depth (top)	Thick-ness	Lithologic Description
(See attached geologic column)				

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thick-ness	Character and Areal Distribution
Mt. Simon	Cambrian	3,109	1,734	Course to fine-grained sandstone with interbedded shale. Occurs throughout Illinois and in adjacent states.

D. Engineering description of injection units

1. Porosity: Range 2.9-[illegible] Average is 11-14%

2. Permeability: Range 1.0 to 1,167 millidarcies Water taken both of core sample to be [illegible] millidarcies

3. Original reservoir pressure: Unknown

4. Reservoir temperature: Unknown

5. Chemical Character of formation Water: Total dissolved solids about 60,000 ppm, chlorides about 35,000 ppm. Swab testing of the Galesville sandstone yielded water with a total dissolved solids content of about 16,000 ppm.

6. Reservoir fracture pressure: Unknown

IV. Geology & Hydrology, continued

E. Hydrology, fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality
Recent drift	0-175'	175'	gravel, sand & clay	fresh
Pots. Co.	1874'	118'	limestone	dissolved solids 585mg/l
				at DePue, Illinois
Neville-Trenton	2535'	132'	limestone	used for water supply
				at Peru and Oglesby

F. Mineral resources (oil and gas, coal, brines, etc.)

Coal, which occurs in Pennsylvanian age rocks, is the only known mineral resource in the area. Pennsylvanian age rocks occur between 175 and 535 feet in the well and are separated from the Galesville sandstone by about 1,710 feet of strata.

V. Well design and construction

A. Casing, Tubing, and Cement

Hole Size	Casing or Tubing Weight & Grade	Size	Depth Set	Type & Amount of Cement
Surface 17 1/2"	0-40, 65#, Stubs Tech-2	13 3/8"	302'	to surface
Intermed. 12 1/4"	0-75, 36#, Stubs Tech-2	9 5/8"	2703'	to surface
8 3/4"	0-50, 23#, Stubs Tech-2	7 "	3108'	to surface
Injection	Fiberglass tubing	3 1/2"	3700'	

Other 7 7/8" hole 3057-4853', 6 1/4" hole 4853-4846

Describe bottom hole completion method: open hole

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: Casing strings were run with centralizers, guide shoes, or float shoes, and float collars.

VI. Description of surface equipment

A. Holding tanks & flow lines 350,000 gal. holding tanks are used before and after filtration (see attached diagram).

B. Filters A diatomaceous earth filter is used to remove particles larger than 5 microns.

C. Pumps A centrifugal pump is used for wastewater injection. A positive displacement pump is used to maintain a positive pressure in the annulus between the tubing and the 7" casing.

D. Other

VII. Cores, Samples, Logs

A. Coring

From	To	Recovery	Unknown
"	"	"	"
"	"	"	"
"	"	"	"
"	"	"	"
"	"	"	"
"	"	"	"
"	"	"	"

B. Drilling time

___ Drillers log

___ Drilling time

X Sample log by the Co. & the Illinois Geological Survey

___ Other:

VII. -- Cores, samples, & logs, continued

C. Other logs run

X Resistivity	___ Gamma ray-neutron
___ SP	___ Temperature
X Caliper	___ Cement bond
___ Other Bulk density, microlog, sonic log	

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Steel mill

B. Physical & chemical Description 70,000gpd of wastewater from steel pickling, containing 0.5% HCl, 24% $FeCl_2$, and 35,000gpd of wastewater containing 1% chromic acid.

C. Volume The volume is variable but estimated to average about 100,000gal./day.

IX. Preinjection waste treatment Settling and filtration

Wastewater chemistry during period 6/30/69 - 2/30/69

CONSTITUENT	MINIMUM CONTENT	MAXIMUM CONTENT
Iron	4.6 mg/l	113 mg/l
Aluminum	---	0.2 mg/l
Chromate	0.01 mg/l	11.0 mg/l
HCl	1,500 mg/l	4,000 mg/l
$FeCl_2$	68,000 mg/l	184,000 mg/l

Temperature about 106°F

Specific gravity about 1.2

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results	
Injectivity	Unknown	Mt. Simon	PSIG	GPM
			410	300
			240	200
			100	100

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results
None reported.		

C. Injection rates and pressures

1. Rate

Date(s)	Overall	Average	~100 gpm	Maximum	~200 gpm
"	April 1969	"	190 gpm	"	
"	May 1970	"	179 gpm	"	
"	July 1971	"	135 gpm	"	
"		"		"	

2. Pressure (well head X bottom hole)

Date(s)		Average	~150 psi	Maximum	~265 psi
"	April 1969	"	265 psi	"	
"	May 1970	"	177 psi	"	
"	July 1971	"	265 psi	"	
"		"		"	

X. Well operation & operating history

D. Description of operating programs: Injection began in December, 1967, and is intermittent.

E. Operating problems: Pump for annulus pressure was originally a centrifugal pump, but was replaced with a positive displacement pump to stabilize flow rate and pressure.

XI. Regulatory aspects.

A. Construction requirements Required to be constructed as specified in the application for the permit.

B. Monitoring requirements Monthly report of injection rate and pressure, annulus pressure, waste character, and other significant operational information.

C. Restrictions on operating procedure None

XII. Economics

A. Total and unit costs of construction

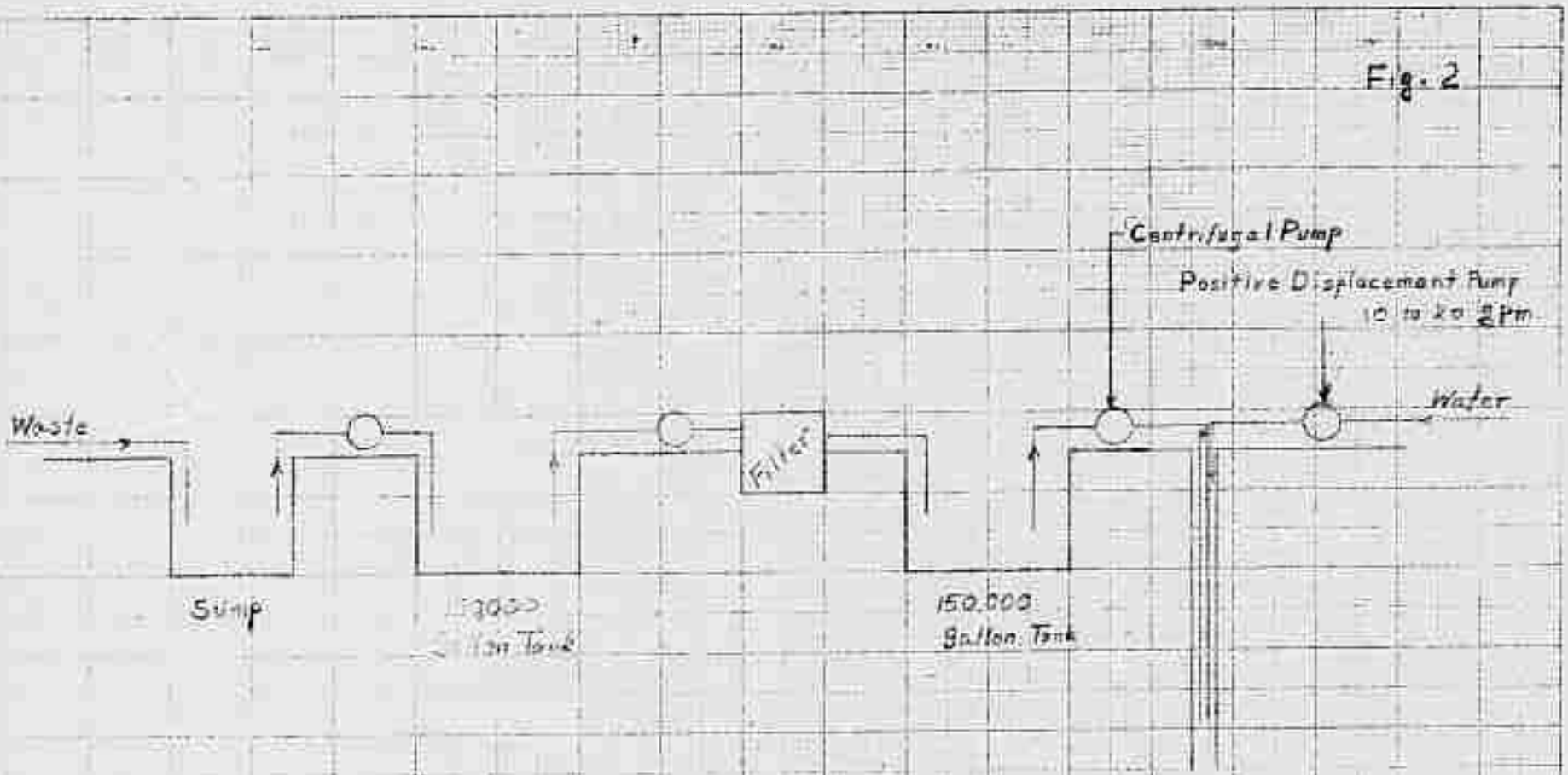
B. Operating costs

XIII. Source(s) of Information and Published References

Illinois Environmental Protection Agency

Illinois Geological Survey

Fig. 2



Schematic Representation of Surface Equipment

Jones & Laughlin Wase Disposal Well, Hennepin, Ill.

JONES & LAUGHLIN STEEL CORPORATION

Waste Disposal Well No. 1
Final Formation Tops

System, Group or Formation	Top	Bottom	Thickness
Pleistocene	0	175	175
Pennsylvanian System	175	385	210
Silurian System	385	930	545
Ordovician System	930	2127	1197
Maquoketa Group	930	1108	178
Brainard Formation	930	1002	72
Ft. Atkinson Formation	1002	1040	38
Scales Formation	1040	1108	68
Galena Group	1108	1474	366
St. Peter Formation	1474	1592	118
Prairie DuChien Group	1592	2127	535
Shakopee Formation	1592	1865	273
New Richmond Formation	1865	1905	40
Oneota Formation	1905	2114	209
Gunter Formation	2114	2127	13
Cambrian System	2127	4843	2716
Knox Group	2127	2380	253
Eminence Formation	2127	2235	108
Potosi Formation	2235	2380	145
Potsdam Group	2380	4843	2463
Franconia Formation	2380	2535	155
Ironton Formation	2535	2643	108
Galesville Formation	2643	2705	62
Eau Claire Formation	2705	3109	404
Mt. Simon Formation	3109	4843	1734
Pre-Cambrian Granite	4843	4846+	--

EXHIBIT I

WELL FILE NUMBER Not permitted / STATE — II-4 / UMR

I. **Operating Company & General Well Location**

American Potash and Chemical Company
West Chicago

II. **Well location (legal description)**

Location: SW 1/4, Sec. 9, T39N, R9E, Dupage County.

III. **History, system planning, construction & operation.**

In August, 1966, a report discussing the feasibility of deep well disposal at the American Potash and Chemical Company Plant, at West Chicago, was submitted to the Sanitary Water Board. The Company submitted a formal application to the Sanitary Water Board for a permit to drill and operate a disposal well October 11, 1966. A November 7 letter from the Board to the Company stated that, a permit would not be issued to operate a disposal well until a test well was drilled and evaluated.

Drilling began on the well December 1, and water samples were obtained from the interval from 2,250 to 2,280 feet. The water samples contained a maximum of about 3,000 ppm dissolved solids. The Company completed drilling of the well to a total depth of 4,043 feet in PreCambrian granite. Based on all evidence, the Company was not allowed to use the well for wastewater injection. Since the well could not be used for wastewater injection, it was plugged from the bottom back to a depth of 2,130 feet in 1969, and the casing above 2,130 feet perforated to allow use of the well for water supply.

IV. **Geology & Geohydrology**

A. **Regional geologic setting:** The well is located in northern Illinois, just west of Chicago on the Kankakee arch. Consolidated sediments in the area range in age from Cambrian to Silurian. These beds dip gently southeastward and are overlain by Pleistocene glacial deposits.

IV. Geology & Geohydrology, continued

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included--yes ____; no X).

(Ground elevation 723) (Total well depth 4,043)

Datum for depth measurement Ground

Name	Age	Depth (top)	Thick-ness	Lithologic Description
	Pleistocene	0		gravel, sand, and clay
	Silurian	93		limestone and dolomite
Maquoketa	Ordovician	277		shale
Galena		366		
		547		
Ancell		660		
	Cambrian	1050		
Mt. Simon		1820-4,020		sandstone and shales

C. Geologic Description of injection units & possible units not in use

Rock Unit Name	Age	Depth (top)	Thick-ness	Character and Areal Distribution

D. Engineering description of injection units

1. Porosity:
2. Permeability:
3. Original Reservoir Pressure:
4. Reservoir Temperature:
5. Chemical Character of Formation Water: About 100,000 parts per million dissolved solids in the basal Mt. Simon.
6. Reservoir Fracture Pressure:

IV. Geology & Geohydrology, continued

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality
Fresh water occurs in all units, except lower Mt. Simon.				

F. Mineral Resources (oil and gas, coal, brines, etc.)

No mineral resources occur in the area.

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing. Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface					
Intermed.					
Injection					
Other					

Describe bottom hole completion method:

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc:_____

VI. Description of surface equipment

A. Holding tanks & flow lines _____

B. Filters _____

C. Pumps _____

D. Other _____

VII. Cores, samples, & Logs Considerable coring was done.

A. Coring

From_____to_____Recovery_____

"_____"_____"_____

"_____"_____"_____

"_____"_____"_____

"_____"_____"_____

"_____"_____"_____

B. Drilling Logs

__X__ Drillers Log ____ Drilling time

__X__ Sample log ____ Other: _____

VII. -- Cores, samples, & logs, continued

C. Other logs run A complete log suite was run.

____Resistivity ____Gamma ray-neutron

____SP ____Temperature

____Caliper ____Cement bond

____Other _____

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

B. Physical & chemical Description

C. Volume

IX. Preinjection waste treatment

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results
Numerous drill stem tests were run in the Mt. Simon Formation. Injectivity tests were run in the basal Mt. Simon.			

B. Treatments or Stimulation

Zones treated	Treatment Method	Description of treatment and results
None		

C. Injection rates and pressures (most operated)

1. Rate

Date(s) _____ Range _____ Maximum _____

2. Pressure (well head _____ bottom hole _____)

Date(s) _____ Average _____ Maximum _____

c. Well operation & operating history

D. Description of operating programs:

E. Operating problems:

f. Regulatory aspects.

A. Construction requirements Well was constructed as specified.

B. Monitoring requirements No operating permit was issued.

C. Restrictions on operating procedure

XII. Economics

A. Total and unit costs of construction

B. Operating costs

XIII. Source(s) of Information and Published References

Illinois Environmental Protection Agency

WELL FILE NUMBER Permit No. 1970-EA-517 (STATE) Il-5 (UMR)

I. Operating Company & General Well Location

U. S. Industrial Chemicals Company
Division of National Distillers and Chemical Corporation
P. O. Box 218
Tuscola, Illinois

II. Well location (legal description)

Location: 430 ft. south and 1135 ft. east of the NW corner of section 31, T16N, R8E, Douglas County.

III. History, system planning, construction & operation.

A five page report was submitted by U. S. Industrial Chemicals to the Illinois Health Department December 2, 1969, proposing subsurface injection for about 120 million gallons of wastewater being held in ponds at their plants. In January, U. S. Industrial Chemicals submitted a further report for study. After review of the two reports by these agencies, the Sanitary Water Board agreed in a letter dated February 9, 1970, to permit the Company to drill a test well.

Drilling of the test well began on April 7, 1970, and the total depth of 5,524 feet was reached on May 9. The well was completed and tested, and a well-history report submitted to the Sanitary Water Board May 27, 1970, with a letter requesting a permit to use the well for wastewater injection.

Permit 1970-EA-517 was issued to U. S. Industrial Chemicals granting permission, August 4, 1970, to operate the injection well and to inject into the zone between 5,00 and 5,507 ft. in accordance with all plans and specifications submitted and subject to various additional conditions. The well is presently in operation.

IV. Geology & Geohydrology

A. Regional geologic setting: Well is on the west flank of the Tuscola anticline on the LaSalle arch. Beds at the well dip southwest.

IV. Geology & Geohydrology, continued 2.

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included--yes ___; no X).

(Ground elevation 693) (Total well depth 5,524)

Datum for depth measurement Rotary bushing elev. 708'

Name	Age	Depth (top)	Thick-ness	Lithologic Description
See attachment				

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thick-ness	Character and Areal Distribution
Eminence-Potosi	Cambrian	5,015 to 5,524		very wide spread dolomite with
permeable zones		5,020-5,030		porous and permeable
		5,144-5,176		zones
		5,186-5,194		

D. Engineering description of injection units

1. Porosity: 25 percent (estimated)
2. Permeability:
3. Original Reservoir Pressure: Static fresh water level was 175 below KB therefore, at 5,500ft. the pressure was 2,309 psi.
4. Reservoir Temperature:
5. Chemical Character of Formation Water: Saline
6. Reservoir Fracture Pressure: Unknown-Not Fractured

Name	Age	Depth (top)
glacial drift	Quaternary	surface
undifferentiated	Pennsylvanian	---
Cypress Sandstone	Mississippian	1,246
Paint Creek	Mississippian	1,302
Bethel-Benoist	Mississippian	1,318
Aux Vases Sandstone	Mississippian	1,384
St. Geneieve	Mississippian	1,425
Rosiclaire	Mississippian	1,458
Fredonia Limestone		1,472
St. Louis Limestone		1,550
Salem Limestone		1,706
Warsaw Limestone		1,786
Osage Shale		1,820
Corper Sandstone		2,200
New Albany Shale	Devonian	2,314
	Silurian	2,470
Maquoketa Shale	Ordovician	3,105
Golena Limestone	Ordovician	3,313
Decora Shale	Ordovician	3,464
Glenwood Shale	Ordovician	3,826
St. Peter Sandstone	Ordovician	3,886
Shakopee Dolomite	Ordovician	4,064
New Richmond Shale	Ordovician	4,124
Oneta	Ordovician	4,400
Eminence	Cambrian	4,984
Potosi	Cambrian	5,075

IV. Geology & Geohydrology, continued

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality
Glacial drift		fresh water extends to		a drill stem test at
Silurian		less than 2,400 ft.		2,412-2,510 yielded water with dissolved solids content of 14,160 mg/l.

F. Mineral Resources (oil and gas, coal, brines, etc.)

The Tuscola anticlinel is an oil producing structure, with production starting in 1962. The pay zone is the Kimmswick (Trenton). Oil shows are present in Pennsylvanian, Devonian, and Silurian rocks.

Coal is mined near Newman, west of the area. The coal beds are in the Pennsylvanian System.

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing. Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface	17 1/2"		13 3/8"	219	200sks 3% $CaCl_2$
Intermed.	12 1/4"	H-40	9 5/8"	2,810	700sks Howco Lite +
	8 3/4"	J-55	7 "	5,015	850 " 100 Class A
Injection	6 1/2"	EUE J-55 w/plastic lining	2.875 OD	4,990	

Other annulus filled w/fresh water and 2bbls Coretron w/crude oil at bottom

Describe bottom hole completion method: open hole

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc:

Centralizers every 90 ft. on 9 5/8" & 7" casing

Halliburton R-4 tubing packer

Continuous pressure recorder on tubing and annulus and flow meter on tubing.

VI. Description of surface equipment

A. Holding tanks & flow lines Waste is transferred from lagoon No. 3 through 4 in. diameter plastic pipe.

B. Filters None - a strainer is used on the well head.

C. Pumps None

D. Other

VII. Cores, samples, & Logs

A. Coring

From _____ to _____ Recovery _____

" _____ _____ _____

" _____ _____ _____

" _____ _____ _____

" _____ _____ _____

" _____ _____ _____

B. Drilling Logs

____ Drillers Log

__X__ Sample log

____ Drilling time

____ Other: _____

VII. -- Cores, samples, & logs, continued

C. Other logs run

____Resistivity	____Gamma ray-neutron
_X_ SP	____Temperature
____Caliper	_X_ Cement bond

____Other Induction - Laterlog 219' to TD

VIII. Waste Characteristics

A. Industrial Process from which waste is derived
Manufacture of various petrochemical and agricultural chemicals.

B. Physical & chemical Description Wastewater containing $CaSO_4$, phosphoric acid (3%), sulfuric acid 1 1/2%), fluoride (0.7%), carbon, and other salts (company description). The waste has a pH of about 1.0 and a specific gravity of 1.034 at 60°F.

C. Volume 80 acres of ponds contain this waste, which will not be produced after 1971. (about 130,000,000 gal.)

IX. Preinjection waste treatment holding in ponds

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results	
1st Injectivity	---	5,015-5,524	Gage Press	GPM Injected
			120 psi	98
			200 psi	136
			525 psi	200
			675 psi	243
2nd after acidizing			300 psi	150
			500 psi	220
Drill stem		2,412-2,510	water salinity>10,000ppm	

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results
5,015-5,524	5,000 gal. 28% HCl - before first injectivity test	
"	5,000 gal. 28% HCl - before second injectivity test	
5,176 & 5,186-5,194 perforated 3shots/ft.		

C. Injection rates and pressures

1. Rate

Date(s) Sept. 1, 1970 Average 485,000gal Maximum ____

" March 22, 1971 " 370,000gal " ____

" May 1, 1971 " 432,000gal " ____

" August 31, 1971 " 446,000gal " ____

" ____ " ____ " ____

2. Pressure (well head ____ X ~~Casing~~ bottom hole Tubing)

Date(s) Sept. 1, 1970 Average 30-100psi Maximum 6psi

" March 22, 1971 " 52psi " 22psi

" May 1, 1971 " 52psi " 16psi

" August 31, 1971 " 52psi " 10psi

" ____ " ____ " ____

Cumulative amount injected to August 31, 1971, 92,963,000gal.

X. Well operation & operating history

D. Description of operating programs:

E. Operating problems: Packer unseated Oct. 1970, well was shut down during part of October and all of November, December, and January and February 1971. Operation was resumed in March with a new packer. A third packer was installed in May 1971.

XI. Regulatory aspects. - (See system history)

A. Construction requirements Well was to be constructed as designed and approved.

B. Monitoring requirements Monthly report of operating pressures and injected volumes, annulus pressure, waste character, and any other significant operational information.

C. Restrictions on operating procedure Waste water injected limited to that approved. Injection pressures not to exceed 0.65 psi/foot of depth at the bottom of the hole.

XII. Economics

A. Total and unit costs of construction

B. Operating costs

XIII. Source(s) of Information and Published References

Illinois Environemtal Protection Agency

Illinois Geological Survey

WELL FILE NUMBER

STATE: IN-1

UMR

I. Operating Company & General Well Location

American Cyanimid Company

P. O. Box 262

Michigan City, Indiana 46360

Phone 219-874-6211

II. Well location (legal description)

Location: Sec. 22, T38N, R4W, LaPorte County, Indiana.

III. History, system planning, construction & operation.

Well 1 began operating in disposing waste water in Aug., 1951 and is still in operation.

IV. Geology & Geohydrology

A. Regional geologic setting. The well is located on the northern flank of the Kankakee Arch. The regional dip is to the northeast. The stratigraphic section consists of sandstone, shale, limestone, and dolomite of Cambrian to Devonian age.

IV. Geology & Geohydrology, continued

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included yes ____; no X).

(Ground elevation 611 ft.) (Total well depth 650 ft.)

Datum for depth measurement Ground Level

Name	Age	Depth (top)	Thickness	Lithologic Description

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thickness	Character and Areal Distribution
Devonian & Silurian		270ft.	397ft.	dolorite and limestone

D. Engineering description of injection units

1. Porosity: vuggy and intergranular
2. Permeability:
3. Original Reservoir Pressure:
4. Reservoir Temperature:
5. Chemical Character of Formation Water: 50mg/l H_2S, 4,000mg/l NaCl
6. Reservoir Fracture Pressure:

IV. Geology & Geohydrology, continued

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality
drift	0ft.	175ft.	sand & gravel	

F. Mineral Resources (oil and gas, coal, brines, etc.)

Peat, marl, and sand are mined in LaPorte County.

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing. Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface			16in.	255ft.	
Intermed.			12in.	170-257ft.	
Injection		Carlon tubing	6in.	270ft.	
Other					

Describe bottom hole completion method: open hole completion

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: _____

VI. Description of surface equipment

A. Holding tanks & flow lines 3 settling tanks in series

B. Filters _____

C. Pumps _____

D. Other _____

VII. Cores, samples, & Logs

A. Coring

From _____ to _____ Recovery _____

" _____ _____ _____

" _____ _____ _____

" _____ _____ _____

" _____ _____ _____

" _____ _____ _____

B. Drilling Logs

____Drillers Log ____Drilling time

____Sample log ____Other: _____

VII. -- Cores, samples, & logs, continued

C. Other logs run

____Resistivity
____SP
____Caliper
____Other

____Gamma ray-neutron
____Temperature
____Cement bond

VIII. Waste Characteristics

A. Industrial Process from which waste is derived
Floor washing waste and filter washing waste.

B. Physical & chemical Description 14,000ppm TDS, 6,500mg/l Na_2SO_4, 5000mg/l ammonium sulfate, 120mg/l acidity, Specific gravity 1.0, pH 4.6, Temperature 60°F.

C. Volume 500 - 600 gpm

IX. Preinjection waste treatment Sedimentation

X. Well operation & operational history

A. Tests

Type	Duration	Zones tested	Description of test results
Injection	---	open hole	500gpm at 21psi

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results
None		

C. Injection rates and pressures

1. Rate

Date(s)		Average 400gpm	Maximum 600gpm
"		"	"
"		"	"
"		"	"

2. Pressure (Well Head [illegible] bottom hole [illegible])

Date(s)		Average	Maximum

X. Well operation & operating history

D. Description of operating programs:

E. Operating problems: Well #1 - The originial casing failed in 1954. It was replaced with Carlon plastic pipe.

XI. Regulatory aspects.

A. Construction requirements

B. Monitoring requirements Monthly operational reports are filed with the state board.

C. Restrictions on operating procedure

XII. Economics

A. Total and unit costs of construction $23,000.00

B. Operating costs $500.00 per year for boths well.

XIII. Source(s) of Information and Published References

Indiana Stream Pollution Control Board

Indiana Geological Survey

WELL FILE NUMBER

STATE

IN-2
UNIT

I. Operating Company & General Well Location

American Cyanimid Company
P. O. Box 262
Michigan City, Indiana 46360
Phone 219-874-6211

II. Well location (legal description)

Location: Sec. 22, T38N, R4W, LaPorte County, Indiana - 850ft. east of the first well.

III. History, system planning, construction & operation.

The well began operating in 1952 and is still in operation.

IV. Geology & Geohydrology

A. Regional geologic setting: The well is located on the northern flank of the Kankakee Arch and the regional dip in this area is to the northeast. The stratigraphic section consists of sandstone, shale, limestone, and dolomite of Cambrian to Devonian age.

IV. Geology & Geohydrology, continued 2.

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included -yes ___; no X).

(Ground elevation 612 ft.) (Total well depth 295 ft.)

Datum for depth measurement Ground Level

Name	Age	Depth (top)	Thickness	Lithologic Description

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thickness	Character and Areal Distribution
---	Devonian	255ft.	40ft.	dolomite and limestone

D. Engineering description of injection units

1. Porosity: vugular and intergranular
2. Permeability:
3. Original Reservoir Pressure:
4. Reservoir Temperature:
5. Chemical Character of Formation Water: 50mg/l H_2S, 4,000 mg/l NaCl
6. Reservoir Fracture Pressure:

IV. Geology & Geohydrology, continued

E. Geohydrology, fresh water aquifers in vicinity

Name	Depth	Thick. feet	Character	Chemical Quality

F. Mineral Resources (oil and gas, coal, brines, etc.)

Same as IV-1

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing Weight & Grade	Size	Depth Set	Type & Amount of Cement
Surface			10 3/4in.	255ft.	
Intermed.					
Injection		Carlon tubing	6 in.	270ft.	
Other					

Describe bottom hole completion method: open hole completion

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: _____

VI. Description of surface equipment

A. Holding tanks & flow lines 3 settling tanks in series

B. Filters _____

C. Pumps _____

D. Other _____

VII. Cores, samples, & Logs

A. Coring

From _____ to _____ Recovery _____

" _____ _____ _____

" _____ _____ _____

" _____ _____ _____

" _____ _____ _____

" _____ _____ _____

B. Drilling Logs

____Drillers Log ____Drilling time

____Sample log ____Other: _____

_____

VII. -- Cores, samples, & logs, continued

C. Other logs run

___Resistivity ___Gamma ray-neutron

___SP ___Temperature

___Caliper ___Cement bond

___Other

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Same as In-1

B. Physical & chemical Description Same as In-1

C. Volume 500 - 600 ppm

IX. Preinjection waste treatment Sedimentation

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results
Injection	---	open hole	936gpm at 19.0psig

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results
None		

C. Injection rates and pressures

1. Rate

Date(s) _____ Average 400 gpm Maximum 600 gpm

" _____ " _____ " _____

" _____ " _____ " _____

" _____ " _____ " _____

" _____ " _____ " _____

2. Pressure (well head X bottom hole _____)

Date(s) _____ Average 35 psig Maximum _____

" _____ " _____ " _____

" _____ " _____ " _____

" _____ " _____ " _____

" _____ " _____ " _____

X. Well operation & operating history

D. Description of operating programs:

K. Operating problems: No problems were reported

XI. Regulatory aspects.

A. Construction requirements

B. Monitoring requirements

C. Restrictions on operating procedure

XII. Economics

a. Total one time cost of conservation $5,000.00

b. Operating costs $250.00 per year for both units

XIII. Financial Assistance and Technical Information

Indiana Shared Pollution Control Funds

Indiana Technical Survey

WELL FILE NUMBER _____ STATE IN-3 UMR

I. Operating Company & General Well Location
Indiana Farm Bureau Coop. Assn. Inc.
Mt. Vernon, Indiana

II. Well location (legal description)
Location: Sec. 6, T7S, R13W, Posey County, Indiana

III. History, system planning, construction & operation.
This well was originally completed as an oil test in April, 1950. It was converted to a disposal well and began operating in October, 1955. Originally it extended into the Hardinsburg at 2457 ft. and was later plugged back to 2328 ft.

IV. Geology & Geohydrology
A. Regional geologic setting: The well is located on the east flank of the Illinois Basin. The regional dip is to the southwest. The stratigraphic section consists of sandstone, shale, limestone and dolomite of Cambrian to Pennsylvanian age.

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included -yes___; no X).
(Ground elevation_____) (Total well depth 2427 ft.)
Datum for depth measurement 416' Derrick floor

Name	Age	Depth (top)	Thickness	Lithologic Description
	Pennsylvanian			
Kinkaid	Mississippian			limestone
Menard	Mississippian			limestone
Vienna	Mississippian			sandy limestone
Tar Springs	Mississippian			sandstone

C. Geologic Description of injection units & possible units not in use

Rock Unit Name	Age	Depth (top)	Thickness	Character and Areal Distribution
Tar Springs	Mississippian	2264'	100ft.	sandstone

D. Engineering description of injection units

1. Porosity: 20% (estimated)
2. Permeability: 200 millidarcies (estimated)
3. Original Reservoir Pressure:
4. Reservoir Temperature:
5. Chemical Character of Formation Water: Brine
6. Reservoir Fracture Pressure:

IV. Geology & Geohydrology, continued

E. Geohydrology, fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality
Drift	0ft.	200ft.	sand & clay	< 1000ppm TDS

F. Mineral Resources (oil and gas, coal, brines, etc.)

Clay and marl are recovered near the well.

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing: Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface	11 in.		10 1/2in.		100 sacks
Intermed.	8 1/4in.		5 1/2in.		150 sacks
Injection			2 1/2in.		
Other					

Describe bottom hole completion method: perforated - 40 holes at 2302 ft. to 2808

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: No packer

VI. Description of surface equipment

A. Holding tanks & flow lines

B. Filters

C. Pumps

D. Other

VII. Cores, sampler, & Logs

A. Coring

From	to	Recovery

B. Drilling Logs

___Drillers Log

___Sample log

___Drilling time

___Other

VII. -- Cores, samples, & logs, continued

C. Other logs run

___Resistivity ___Gamma ray-neutron

___SP ___Temperature

___Caliper ___Cement bond

___Other

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

B. Physical & chemical Description Water, sodium, hydroxide, sodium sulfide, sodium mercaptide, Specific gravity 1.12

C. Volume 4,500 gal. every 1 to 4 weeks

IX. Preinjection waste treatment settling

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results
None			

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of treatment and results
Perforated Zone	Acidization	15% muriatic acid + Dowell L-1 & W-9 additives
" "	Hyd. Fracturing	3000 gal. - water at 7500 psi

C. Injection rates and pressures

1. Rate

Date(s) _____ Average 6300gal. per month Maximum _____

2. Pressure (well head X bottom hole _____)

Date(s) _____ Average 200psi Maximum 350psi

X. Well operation & operating history

D. Description of operating programs: Waste is injected approximately once each month

E. Operating problems: No problems were reported.

XI. Regulatory aspects.

A. Construction requirements

B. Monitoring requirements

C. Restrictions on operating procedure

XII. Economics

A. Total and unit costs of construction $19,000.00

B. Operating costs $100.00

XIII. Source(s) of information and additional references.

Indiana Stream Pollution Control Board

Indiana Geological Survey

WELL FILE NUMBER

STATE

IN-4
UMR

I. Operating Company & General Well Location

F M C Corporation

P. O. Box 34

Newport, Indiana

Phone Ch-5-2251

II. Well location (legal description)

Location: Ne 1/4, NW 1/4, Sec. 9, T16N, R6W Vermillion County, Indiana. -Newport Army Ammunition Plant.

III. History, system planning, construction & operation.

The well was completed on May 22, 1960 and began operation during the same year. In 1966, a cathode type protection system was installed. The well is presently inactive, but has not been plugged.

IV. Geology & Geohydrology

A. Regional geologic setting: The well is located on the northeast flank of the Illinois Basin. The regional dip is to the southwest. The stratigraphic section consists of sandstone, shale, limestone, and dolomite of Cambrian to Pennsylvanian age.

IV. Geology & Geohydrology, continued

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included--yes____; no X).
(Ground elevation_____) (Total well depth 6160 ft.)
Datum for depth measurement Ground Level

Name	Age	Depth (top)	Thick-ness	Lithologic Description
Cincinnatian	Ordovician	1880ft.	319ft.	shale
Trenton	Ordovician	2199ft.	161ft.	limestone
Black River	Ordovician	2360ft.	450ft.	limestone
Knox	Cambrian	2819ft.	1600ft.	dolomite
Eau Claire	Cambrian	4420ft.	840ft.	limestone & shale
Mt. Simon	Cambrian	5260ft.	900ft.	limestone

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thick-ness	Character and Areal Distribution
Mt. Simon	Cambrian	5260ft.	900ft.	fractured sandstone

Injection interval 5450 to 6160 ft.

D. Engineering description of injection units

1. Porosity: 6%
2. Permeability: 6 to 8 md
3. Original Reservoir Pressure:
4. Reservoir Temperature:
5. Chemical Character of Formation Water: 204,400 ppm TS, 125,000 ppm Cl, 508 ppm SO_4, 116 ppm $(CO_3)_2$, 22,400 ppm Ca, 2,840 ppm Mg, pH - 4.5
6. Reservoir Fracture Pressure:

IV. Geology & Geohydrology, continued

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality

F. Mineral Resources (oil and gas, coal, brines, etc.)

The area around the disposal well is an area of large coal deposits. Over 150 million tons of coal has been produced from the deposits.

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface	13 3/4in.		10 3/4in.	498ft.	
Intermed.	9 in.	23lb/ft.	7 in.	5450ft.	
Injection					
Other					

Describe bottom hole completion method: open hole completion 710 ft.

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: _____

VI. Description of surface equipment

A. Holding tanks & flow lines 13,000 gal. waste rundown tank and a surge tank

B. Filters Leaf filters and cartridge filters

C. Pumps 23 stage centrifugal pump

D. Other _____

VII. Cores, samples, & Logs

A. Coring Intermittantly

From	4500 ft.	to 6160 ft.	Recovery 354 ft. - 97.5%
"			
"			
"			
"			
"			

B. Drilling Logs

____ Drillers Log

X Sample log

____ Drilling time

X Other: lithologic log

VII. -- Cores, samples, & logs, continued

C. Other logs run

X Resistivity	___ Gamma ray-neutron
X SP	___ Temperature
X Caliper	___ Cement bond
X Other Velocity, Lateralog	

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Chemical waste

B. Physical & chemical Deacription 22,000 mg/l Ca, 9,000 mg/l Fe, 3,000 mg/l Mg, 125,000 ppm Cl, 10 ppm solids (after filtration), Specific gravity 1.09, pH 4.0

C. Volume

IX. Preinjection waste treatment pH control, sedimentation, and filtration

X. [illegible]

A. Tests

Test Number	Description	Items Tested	Description of Test Results
None			

B. Treatments or Dispositions

Items Treated	Treatment Applied	Description of Treatment and Results
[illegible]	[illegible]	250,000 gal. fresh water and 250,000 gal. gas condensate waste water

C. Injection Wells and Aquifers

1. Data

Injection Pressure 10 psig Volume 100 gal

a.	[illegible]	a.	[illegible]
b.	[illegible]	b.	[illegible]
c.	[illegible]	c.	[illegible]
d.	[illegible]	d.	[illegible]

2. Pressure Limit None 0 Volume None)

Injection Pressure Limit Vol Num Vol Unit

a.	[illegible]	a.	[illegible]
b.	[illegible]	b.	[illegible]
c.	[illegible]	c.	[illegible]
d.	[illegible]	d.	[illegible]

X. Well operation & operating history

D. Description of operating programs:

E. Operating problems: 1) Bore hole collapsed in 1962 and was drilled out at a cost of $30,000. 2) Waste and formation water formed a precipitate. This was alleviated by buffer injection.

XI. Regulatory aspects.

A. Construction requirements

B. Monitoring requirements

C. Restrictions on operating procedure

XII. Economics

8.

A. Total and unit costs of construction $290,000.00

b. Operating costs

XIII. Source(s) of Information and Facilities Reference.

Indiana Stream Pollution Control Board

Indiana Geological Survey

WELL FILE NUMBER

IN-5

I. Operating Company & General Well Location

Bethlehem Steel Corporation

Chesterton, Indiana

II. Well location (legal description)

Location: Sec. 26, T37N, R6W, Porter County, Indiana.

III. History, system planning, construction & operation.

The well began operating in November 1967. The well was originally used to dispose of sulfuric acid and now it disposes of hydrochloric acid. The well is still in operation.

IV. Geology & Geomorphology

A. Regional geologic setting. The well is on the northeast flank of the Cambrian Arch and the regional dip in the area is to the northeast. The stratigraphic section consists of sandstone, shale, limestone, and dolomite of Cambrian to Devonian age.

IV. Geology & Geohydrology, continued

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included yes ___; no X).

(Ground elevation 624 ft.) (Total well depth 4304 ft.)

Datum for depth measurement Kelly Bushing

Name	Age	Depth (top)	Thickness	Lithologic Description
	Silurian	2546ft.	700ft.	shale
Trenton	Ordovician	3246ft.	740ft.	limestone
Black River	Ordovician	3986ft.	100ft.	limestone
Knox	Cambrian	4086ft.	300ft.	dolomite
Eau Claire	Cambrian	4386ft.	400ft.	limestone
Mt. Simon	Cambrian	4786ft.	1700ft.	sandstone
	Precambrian	4486		

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thickness	Character and Areal Distribution
Mt. Simon	Cambrian	2486ft.	1700ft.	sandstone

D. Engineering description of injection units

1. Porosity: 9% intergranular
2. Permeability:
3. Original reservoir pressure:
4. Reservoir temperature:
5. Chemical Character of Formation Water: 40,000 mg/l NaCl, 7,000 mg/l Ca
6. Reservoir fracture pressure:

IV. Geology & Geohydrology, continued

E. Geohydrology, fresh water aquifers in vicinity

Name	Depth	Thick. feet	Character	Chemical Quality
drift		190	sand & gravel	

F. Mineral Resources (oil and gas, coal, brines, etc.)

Clay and marl are mined in Porter County.

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface	24in.		20in.		
Intermed.	15in.	H-40 32lb.	10 3/4in.		
	8 3/4in.	H-40 17lb.	7in.		
Injection	6 1/4in.	J-55 Tubing	3 1/2in.O.D.		
		Fenstra coated			

Other

Describe casing hole completion method: perforated completion

below 298 ft.

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: 2 Baker Model D packers

VI. Description of surface equipment

A. Holding tanks & flow lines

B. Filters precoat filter 2 microns

C. Pumps

D. Other

VII. Cores, samples, & logs

A. Coring

From	to	Recovery

B. Drilling logs

X Drillers log

Sample log

Drilling time

X Other: lithologic log

VII. -- Cores, samples, & logs, continued

C. Other logs run

X Resistivity	X Gamma ray-neutron
___ SP	X Temperature
X Caliper	___ Cement bond
X Other Formation density, acoustic	

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Steel mill

B. Physical & chemical Description 71,600 ppm TDS, 6-10% H_3BO_3, 14-18% $FeSO_4$, 41,000 ppm Cl, 22,000 ppm Na_2O, temperature 40-120°F.

C. Volume

IX. Preinjection waste treatment Filtration, addition of biocide and corrosion and oxygen inhibitors

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results
Injection	---	perforated zone	2400 bwd at 500 psi

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results
Perforated zone	Acidization	15% HCl

C. Injection rates and pressures

1. Rate

Date(s) Overall Average 12% gpm Maximum

2. Pressure (well head X bottom hole)

Date(s) Average 700 psi Maximum

X. Well operation & operating history

D. Description of operating programs:

E. Operating problems: No problems were reported.

XI. Regulatory aspects.

A. Construction requirements:

B. Monitoring requirements:

C. Restrictions on operating procedure:

XII. Economics

A. Total and unit costs of construction $500,000.00

B. Operating costs $12,000.00 per year

XIII. Source(s) of Information and Pertinent References

Indiana Stream Pollution Control Board

Indiana Geological Survey

WELL FILE NUMBER

~~STATE~~ IN-6
~~U.S.~~ UNIT

I. Operating Company & General Well Location

Bethlehem Steel Corporation
Burns Harbor Plant
Box 248
Chesterton, Indiana

II. Well location (legal description)

Location: Sec. 10, T37N, R6W, Porter County, Indiana.

III. History, system planning, construction & operation.

This well was completed on April 4, 1968 and began operation soon after completion. The well is still in operation.

IV. Geology & Geohydrology

A. Regional geologic setting: The well is located on the northeast flank of the Kankakee Arch. The regional dip is to the northeast. The stratigraphic section consists of sandstone, shale, limestone, and dolomite of Cambrian to Devonian age.

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included--yes____; no____).

(Ground elevation 613 ft.) (Total well depth 3945 ft.)

Datum for depth measurement Ground Level

Name	Age	Depth (top)	Thick-ness	Lithologic Description
	Silurian	250ft.	695ft.	shale & limestone
Trenton	Ordovician	945ft.	215ft.	limestone
Black River	Ordovician	1160ft.	185ft.	limestone
Knox	Cambrian	1355ft.	300ft.	dolomite
Eau Claire	Cambrian	1662ft.	900ft.	limestone
Mt. Simon	Cambrian	2510ft.	3945ft.	sandstone

C. Geologic Description of injection units & possible units not in use

Rock Unit Name	Age	Depth (top)	Thick-ness	Character and Areal Distribution
Mt. Simon	Cambrian	2530"	1411.ft.	sandstone

D. Engineering description of injection units

1. Porosity: 10 - 20%
2. Permeability: 20 - 100 md
3. Original Reservoir Pressure:
4. Reservoir Temperature: 92°F
5. Chemical Character of Formation Water: 98,000 TS, 58,000 ppm Cl, 1210 ppm SO_4, 78.1 ppm HCO_3, 8140 ppm Ca, 1320 ppm Mg, 27,000 ppm Na
6. Reservoir Fracture Pressure:

IV. Geology & Geohydrology, continued

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality
drift		190	sand & clay	

F. Mineral Resources (oil and gas, coal, brines, etc.)

Clay and marl are mined from Porter County.

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing. Weight & grade		Size	Depth Set	Type & Amount of Cement
Surface	17 in.	H-40	55 lb.	13 3/8in.	226ft.	300 sacks
Intermed.	12 1/4in.	J-55	48 lb.	9 5/8in.	1437ft.	500sacks
	8 3/4in.	J-55	23lb.	7 in.	2530ft.	525sacks
Injection	6 1/4in.					

Other

Describe bottom hole completion method: open hole completion

V. Well design and construction, continued

B. Packers, Centralizers, well test equipment, etc: _____

VI. Description of surface equipment

A. Holding tanks & flow lines 2 - 210,000 gal. storage tanks, 1 - 50,000 gal. storage tank.

B. Filters 2 - Diatomaceous earth filters

C. Pumps _____

D. Other 2 - Gas chlorinators (1 in use)

VII. Cores, samples, & logs

A. Cores

From	To	Recovery

B. Drilling cuttings

1 Drillers log

1 Sample log

Drilling time

1 Other: Lithologic log

VII. -- Cores, samples, & logs, continued

C. Other logs run

___ Resistivity	X Gamma ray-neutron
___ SP	___ Temperature
X Caliper	___ Cement bond
X Other Formation density, velocity	

VIII. Waste Characteristics

A. Industrial Process from which waste is derived
Waste effluent from a coke plant

B. Physical & chemical Description Aqueous ammonium salts containing phenols and cyanides.

C. Volume 450 gpm - maximum

IX. Preinjection waste treatment Oil skimming, sludge removal filtration, temperature reduction, and addition of Biocide.

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results
None			

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results
None		

C. Injection rates and pressures

1. Rate

Date(s) Overall Average 125 mcm Maximum

2. Pressure (well head 1 bottom hole)

Date(s) Average 700 psi Maximum

X. Well operation & operating history

D. Description of operating programs:

E. Operating problems: There were several tubing leaks. The tubing was replaced.

XI. Regulatory aspects.

A. Construction requirements

B. Monitoring requirements

C. Restrictions on operating procedure

XII. Economics

A. Total and unit costs of construction

b. Operating costs

XIII. Source(s) of information and Publications Reference.

Indiana Stream Pollution Control Board

Indiana Geological Survey

WELL FILE NUMBER

~~EWIT~~ IN-7

I. Operating Company & General Well Location

Bethlehem Steel Corp.
Burns Harbor Plant
Box 248
Chesterton, Indiana

II. Well location (legal description)

Location: Sec. 29, T37N, R6W, Porter County, Indiana.

III. History, system planning, construction & operation.

The well was completed on March 22, 1968 and began operating soon after completion. This well is still in operation.

IV. Geology & Geohydrology

A. Regional geologic setting: The well is located on the northeast flank of the Kankakee Arch. The regional dip is to the northeast. The stratigraphic section consists of sandstone, shale, limestone, and dolomite of Cambrian to Devonian age.

IV. Geology & Geohydrology, continued

B. Geologic description of rock units penetrated by well
Rock Unit (Geologic Column included -yes___; no___).
(Ground elevation 611 ft.) (Total well depth 4301 ft.)
Datum for depth measurement Ground Level

Name	Age	Depth (top)	Thickness	Lithologic Description
Silurian	Silurian	238	520ft.	shale & limestone
Cincinnatian	Silurian	758	200ft.	limestone
Trenton	Ordovician	958	225ft.	limestone
Black River	Ordovician	1173	170ft.	limestone
Knox	Cambrian	1340	315ft.	dolomite
Eau Claire	Cambrian	1655	885ft.	limestone
Mt. Simon	Cambrian	2530	1745ft.	sandstone

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thickness	Character and Areal Distribution
Eau Claire	Cambrian	1655ft.	885ft.	limestone
Mt. Simon	Cambrian	2530ft.	1745ft.	sandstone

D. Engineering description of injection units

1. Porosity: 10 - 20% intergranular
2. Permeability: 20 - 100 md
3. Original Reservoir Pressure:
4. Reservoir Temperature: 92°F
5. Chemical Character of Formation Water: Same as In-6
6. Reservoir Fracture Pressure:

IV. Geology & Geohydrology, continued 3.

E. Geohydrology, fresh water aquifers in vicinity

Name	Depth	Thick. near	Character	Chemical Quality
drift		100ft.	sand & gravel	

F. Mineral Resources (oil and gas, coal, brines, etc.)

None as far

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface	17 1/2"	H-40 54lb.	13 3/8in.	230ft.	300 sacks
Intermed.	12 1/4"	J-55 32lb.	9 5/8in.	1455ft.	
	8 3/4"	23lb/ft.	7in.	2321ft.	
Injection	6 1/4"	Open hole below		2321 ft.	

Other

Describe bottom hole completion method: open hole

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: _____

VI. Description of surface equipment

A. Holding tanks & flow lines 2 - 400,000 gal. storage tanks, 1 - 60,000 gal. storage tank

B. Filters 2 diatomaceous earth filters

C. Pumps _____

D. Other 2 Heat exchangers 14°F to 80°F

VII. Cores, Samples, & Logs

A. Coring

From	to	Recovery
•		
•		
•		
•		
•		

B. Drilling Logs

X Drillers Log

X Sample log

___ Drilling time

X Other: Lithologic log

VII. -- Cores, samples, & logs, continued

C. Other logs run

___ Resistivity
___ SP
_X_ Caliper
_X_ Other Velocity, Formation density
___ Gamma ray-neutron
___ Temperature
___ Cement bond

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Waste effluent from a coke plant

B. Physical & chemical Description Aqueous ammonium salts containing phenols and cyanides.

C. Volume 400 gpm - maximum

IX. Preinjection waste treatment Oil skimming, sludge removal filtration, temperature reduction, and addition of Biocide.

X. Well operation & operation history

A. Tests

Type	Duration	Zones tested	Description of test results
None			

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results
None		

C. Injection rates and pressures

1. Rate

Date(s) Overall Average 32 gpm Maximum

2. Pressure (well head X bottom hole)

Date(s) Average 15 psi Maximum

X. Well operation & operating history

D. Description of operating programs: _____

E. Operating problems: _____

XI. Regulatory aspects.

A. Construction requirements _____

B. Monitoring requirements Daily injection volumes and data on waste chemistry to be filed monthly.

C. Restrictions on operating procedure _____

XII. Economics

A. Total and unit costs of construction

B. Operating costs

XIII. Source(s) of Information and Published References

Indiana Stream Pollution Control Board

Indiana Geological Survey

WELL FILE NUMBER _____ STATE IN-8

I. Operating Company & General Well Location

Midwest Steel Division
National Steel Corporation
Portage, Indiana 46368
Supt. of Services (1971) Mr. C. Hortman

II. Well location (legal description) Phone 219-762-3131

Location: Sec. 25, T37N, R7W, Porter County, Indiana

III. History; system planning, construction & operation.

Initial operation began in Feb. 1965. The reason for the well was to alleviate a water sludge problem. The well is still in operation.

All logs are on file with the Indiana Geological Survey.

IV. Geology & Geohydrology

A. Regional geologic setting: The well is located on the northeast flank of the Kankakee Arch. The regional dip is to the northeast. The stratigraphic section consists of sandstone, limestone, dolomite, and shale of Cambrian to Devonian age.

IV. Geology & Geophysics, continued

B. Geologic description of rock units penetrated by well
Rock unit (Geologic reason included yes ___ no ___).
(Ground elevation 5125 ft.) (Total well depth 4100 ft.)
Datum for depth measurements _____

Name	Age	Depth (top)	Thickness	Lithologic Description
	Pliocene	1000'		sand
Ogallala	Undetermined	1375'		limestone
Black Hills	Undetermined	1825'		limestone
Niobrara	Cretaceous	2150'		bentonite
Pierre Shale	Cretaceous	2250'		limestone and shale
Mt. Sibley	Cretaceous	3700'		sandstone
	Carboniferous	3870'		

C. Geologic description of injection wells & possible units not in use

Rock Units

Name	Age	Depth (top)	Thickness	Character and Rock Description
Mt. Sibley	Cretaceous	3700	2100	sandstone

D. Engineering description of injection wells

1. Porosity: see attachment
2. Permeability: 80 x 10 md
3. Natural Reservoir Pressure: _____
4. Reservoir Temperature: _____
5. Chemical Analysis of Formation Water: 40,000 mg/l NaCl, and 1,000 mg/l Ca

6. Reservoir Fracture Gradient: _____

IV. Geology & Geohydrology, continued

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality
Drift	0ft.	190ft.	sand & clay	

F. Mineral Resources (oil and gas, coal, brines, etc.)

Peat and marl are recovered from the county in which the well is located.

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing. Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface	20 in.		16 in.	180ft.	Portland
Intermed.	13 3/8in.		10 2/4in.	400ft.	"
	9 5/8in.		7 in.	2750ft.	"
Injection		Fibercast	2 in.	800ft.	Resin
		"	3 in.	800 to 2750ft.	

Stainless steel tail pipe at end of fibercast tubing string

Other 15ft. of monel casing at end of 7 in. string

Describe bottom hole completion method: open hole completion

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: Packer set near the bottom of the Tin casing string.

VI. Description of surface equipment

A. Holding tanks & flow lines 100,000 gal. storage tank, 3,000 gal. surge tank, and an 80 in. continuous pickle line

B. Filters Precoat filters - .5 microns

C. Pumps 2 booster pumps and 2 (1½ gpm) injection pumps

D. Other rust inhibitor

VII. Cores, samples, & logs

A. Coring

From	To	Recovery
"		
"		
"		
"		
"		

B. Drilling logs

___Drillers log

_X_Sample log

___Drilling time

_X_Other: lithologic log

VII. -- Cores, samples, & logs, continued

C. Other logs run

___Resistivity
X SP
___Caliper
___Gamma ray-neutron
X Temperature
___Cement bond
X Other Sonic log, conductivity log

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Waste pickle from a metals products operation

B. Physical & chemical Description 6 to 10% H_2SO_4, 14 to 18% Ferrous sulfate, Specific Gravity 1.14, Temperature 130°F to 150°F, also contains some Na_2CrO_4

C. Volume

IX. Preinjection waste treatment Filtration

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results
DST	2 hours	open hole	225 gpm at 225 psig
Injection	---	open hole	

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results
open hole	Acidization	Mcl
open hole	Buffer Injection	Injection fresh water with chlorine and biocide B-9 volume - 12,000,000 gal.

C. Injection rates and pressures

1. Rate

Date(s) _____ Average 225 gpm Maximum _____

2. Pressure (well head X bottom hole _____)

Date(s) _____ Average 0 psig Maximum 30 psi

I. Well operation & operating history

D. Description of operating programs: _____

E. Operating problems: The injector tubing ruptured and was replaced.

The buffer injection was required because the effluent reacts with the connate water to precipitate gypsum ($CaSO_4$)

II. Regulatory aspects.

A. Construction requirements _____

B. Monitoring requirements _____

C. Restrictions on operating procedure _____

XII. Economics

a. Total and unit costs of construction $450,000.00

b. Operating costs $5,000.00 per month

XIII. Source(s) of Information and Published References

Indiana Stream Pollution Control Board

Indiana Geological Survey

WELL FILE NUMBER

IX-9

I. Operating Company & General Well Location

U. S. Steel Corp.

208 S. LaSalle Street

Chicago, Illinois 60604

Well in Gary, Indiana

II. Well location (legal description)

Location: Sec. 32, T37N., R6W., Lake County, Indiana

III. History, system planning, construction & operation.

The well began operating in 1965 and is still in operation.

Drilling was completed Jan. 7, 1965.

IV. Geology & Geohydrology

A. Regional geologic setting: The well is located on the southwest flank of the Kankakee Arch. The regional dip is to the southwest. Drainage is into Lake Michigan. The stratigraphic section consists of various sediments of Cambrian to Devonian age.

IV. Geology & Geohydrology, continued

B. Geologic description of rock units penetrated by well
Rock Unit (Geologic Column included -yes____; no____).
(Ground elevation[illegible] ft.KB) (Total well depth 4303 ft.)
Datum for depth measurment Kelly Bushing

Name	Age	Depth (top)	Thick-ness	Lithologic Description
Trenton	Ordovician	845ft.	200ft.	limestone
Black River	Ordovician	1045ft.	160ft.	limestone
Knox	Cambrian	1190ft.	170ft.	dolomite
Eau Claire	Cambrian	1447ft.	200ft.	limestone & shale
Mt. Simon	Cambrian	2422ft.	1880ft.	sandstone

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thick-ness	Character and Areal Distribution
Mt. Simon	Cambrian	2422ft.	[illegible]ft.	sandstone

Injection Interval - 2542 ft. to 4301 ft.

D. Engineering description of injection units

1. Porosity: 18.1 intergranular
2. Permeability: 307 md
3. Original Reservoir Pressure:
4. Reservoir Temperature:
5. Chemical Character of Formation Water: 40,000 mg/l NaCl, 7,000 mg/l Ca
6. Reservoir Fracture Pressure:

IV. Geology & Geohydrology, continued

E. Geohydrology, fresh water aquifers in vicinity

Name	Depth	Thick. ness	Character	Chemical Quality
Drift	0ft.	162ft.	sand & gravel	

V. Mineral Resources (oil and gas, coal, brines, etc.)

Peat is recovered from pits in the general area of the disposal well.

VI. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing. Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface	20 in.	H-40	16 in.	182ft.	375 sacks
Intermed.	13 3/4in.	H-40	10 3/4in.	823ft.	550 sacks
	9 5/8in.	J-55	7 in.	2452ft.	650 sacks +
Injection		Fiberglass	4 1/2in.		40 sacks of resin
Other					

Describe bottom hole completion method: open hole completion

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: Flowmeter and totalizer

VI. Description of surface equipment

A. Holding tanks & flow lines

B. Filters

C. Pumps

D. Other

VII. Cores, samples, & logs

A. Coring

From _____ to _____ Recovery _____

"

"

"

"

"

B. Drilling logs

__X__ Drillers log

__X__ Sample log

____ Drilling time

__X__ Other: Lithologic log

VII. -- Cores, samples, & logs, continued

C. Other logs run

X Resistivity	X Gamma ray-neutron
X SP	X Temperature
X Caliper	X Cement bond
X Other Velocity	

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Spent pickle liquor

B. Physical & chemical Description

Sulfuric acid 8-37%

Ferrous sulfate 19-25%

Chromic acid 2-6%

Hydrochloric acid 1%

$FeCl_2$ 15-20%

Specific gravity 1.06-1.13

C. Volume 6,500,000 gal. per month

IX. Preinjection waste treatment filtration & skimming

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results
None			

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results
open hole	Acidization	2,000 gal. - Dowell mud acid
open hole	Buffer injection	600,000 gal. of chlorinated water

C. Injection rates and pressures

1. Rate

Date(s) _____ Average 210 gpm Maximum 240 gpm

" _____ " _____ " _____

" _____ " _____ " _____

" _____ " _____ " _____

" _____ " _____ " _____

2. Pressure (well head X bottom hole _____)

Date(s) _____ Average 200 psi Maximum _____

" _____ " _____ " _____

" _____ " _____ " _____

" _____ " _____ " _____

" _____ " _____ " _____

X. Well operation & operating history

D. Description of operating programs:

E. Operating problems: No problems were reported.

XI. Regulatory aspects.

A. Construction requirements

B. Monitoring requirements

C. Restrictions on operating procedure

XII. Economics

A. Total and unit costs of construction

B. Operating costs

XIII. Source(s) of information on Facilities Reference

Facilities Status Publication (Name and Number)

Facilities Inventory Survey

WELL FILE NUMBER _____ STATE IN-10 UMR

I. Operating Company & General Well Location

General Electric Company
Lexan Lane
Mt. Vernon, Indiana 47620

II. Well location (legal description)

Location: Sec. 18, T7S, R13W, Posey County, Indiana

III. History, system planning, construction & operation.

The disposal well was originally an oil test well. The well began disposing of waste in February, 1967 and is still in operation.

IV. Geology & Geohydrology

A. Regional geologic setting: The well is located within the Illinois Basin. Locally the well is situated in the center of a graben with normal faults near the well. The stratigraphic section consists of sandstone, shale, limestone, and dolomite of Cambrian through Pennsylvanian age.

B. Geologic description of rock units penetrated by well
Rock Unit (Geologic Column included--yes____; no____).
(Ground elevation 391 ft.) (Total well depth 3054 ft.)
Datum for depth measurement Ground Level

Name	Age	Depth (top)	Thickness	Lithologic Description
Kinkaid	Mississippian	1790ft.		sand, sandstone, shale
Menard	Mississippian	2086ft.		
Vienna	Mississippian	2248ft.		sandy limestone
Glen Dean	Mississippian	2380ft.		limestone & shale
Barlow	Mississippian	2606ft.		shale
Cypress	Mississippian	2635ft.		shale
Bethel	Mississippian	2760ft.		sandstone & shale

C. Geologic Description of injection units & possible units not in use

Rock Unit Name	Age	Depth (top)	Thickness	Character and Areal Distribution
Bethel	Mississippian	2760ft.	46ft.	sandstone

D. Engineering description of injection units

1. Porosity: 16% intergranular
2. Permeability: 100 md
3. Original Reservoir Pressure:
4. Reservoir Temperature:
5. Chemical Character of Formation Water: 110,000 mg/l 6250 mg/l SO_4, 260 mg/l total alkalinity, 1100 mg/l total hardness, 6,400 mg/l Ca, 33.5 mg/l Fe, pH 7.6
6. Reservoir Fracture Pressure:

IV. Geology & Geohydrology, continued

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality
drift	0ft.	200ft.	sand & gravel	

F. Mineral Resources (oil and gas, coal, brines, etc.)

Over 30 million barrels of oil have been produced from the overlying Waltersburg sand. Coal is also produced from the area in large amounts.

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing. Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface			8 5/8in.		
Intermed.	6 3/4in.		4 1/2in.		660 sacks 18% Salt-Pozmix
Injection			2 3/8in.		
Other	Annulus filled with diesel oil				

Describe bottom hole completion method: open hole completion

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: Flowmeter, automatic sampler, continuous rate pressure recorder.

Packer on 2 3/8in. tubing

VI. Description of surface equipment

A. Holding tanks & flow lines

B. Filters 2 cartridge filters - 20 micron cartridge

C. Pumps

D. Other

VII. Cores, samples, & Logs

A. Coring

From	to	Recovery
"		
"		
"		
"		
"		

B. Drilling Logs

X Drillers Log

X Sample log

Drilling time

X Other: lithologic log

VII. -- Cores, samples, & logs, continued

C. Other logs run

X Resistivity	___ Gamma ray-neutron
X SP	___ Temperature
___ Caliper	___ Cement bond

___ Other _____

VIII. Waste Characteristics

A. Industrial Process from which waste is derived Waste from a phenolic distillation facility and acid regeneration system.

B. Physical & chemical Description 3% phenol, Specific gravity 1.003, pH 10 to 13.

C. Volume 48,000 gpd

IX. Preinjection waste treatment Sedimentation, filtration pH control at 8, and injection of a scale corrosion inhibitor.

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results
DST	3.5 hours	open hole	
Injection		" "	40 gpm at 1050 psi

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results
Open hole	Acidization	4000 gal. 25% HCl

C. Injection rates and pressures

1. Rate

Date(s) _____ Average 30 gpm Maximum 40 gpm

" _____ " _____ " _____

" _____ " _____ " _____

" _____ " _____ " _____

" _____ " _____ " _____

2. Pressure (well head X bottom hole _____)

Date(s) _____ Average 465 psi Maximum _____

" _____ " _____ " _____

" _____ " _____ " _____

" _____ " _____ " _____

" _____ " _____ " _____

X. Well operation & operating history

D. Description of operating programs:

E. Operating problems: Back pressure build up occurred due to iron oxide residue. This was corrected by adding an iron chelating agent.

XI. Regulatory aspects.

A. Construction requirements

B. Monitoring requirements Monthly reports with the state on operation.

C. Restrictions on operating procedure

XII. Economics

A. Total and unit costs of construction $50,000.00

B. Operating costs $4,000.00 per year

XIII. Source(s) of Information and Published References

Indiana Stream Pollution Control Board

Indiana Geological Survey

WELL FILE NUMBER

STATE

IN-11
UMR

I. Operating Company & General Well Location

Inland Steel Company
30 W. Monroe Street
Chicago, Ill. 60603

II. Well location (legal description)

Location: Sec. 14, T37N, R9W, Lake County, Indiana.

III. History, system planning, construction & operation.

The well was completed and began operation in March, 1968. This well is still in operation.

IV. Geology & Geohydrology

A. Regional geologic setting: The well is located on the southwest flank of the Kankakee Arch and the regional dip in this area is to the southwest. The stratigraphic section consists of sandstone, shale, limestone, and dolomite of Cambrian to Devonian age.

IV. Geology & Geohydrology, continued

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included -yes ___; no X).

(Ground elevation 608 ft.) (Total well depth 4348 ft.)

Datum for depth measurement Kelly Bushing

Name	Age	Depth (top)	Thickness	Lithologic Description
Cincinnatian	Ordovician	680ft.	100ft.	shale
Trenton	Ordovician	780ft.	220ft.	limestone
Black River	Ordovician	1000ft.	130ft.	limestone
St. Peter	Ordovician	1130ft.	340ft.	sandstone
Eau Claire	Cambrian	1470ft.	890ft.	limestone
Mt. Simon	Cambrian	2360ft.	1980ft.	sandstone
---	PreCambrian	4340ft.		granite

C. Geologic Description of injection units & possible units not in use

Rock Unit Name	Age	Depth (top)	Thickness	Character and Areal Distribution
Mt. Simon	Cambrian	2360ft.	1980ft.	sandstone

injection zone 2550 to 2800 ft.

D. Engineering description of injection units

1. Porosity: 12%
2. Permeability: 316 md
3. Original Reservoir Pressure:
4. Reservoir Temperature:
5. Chemical Character of Formation Water: 123,000 ppm TDS, 75,900 ppm Cl, 1,300 ppm SO_4, 31,500 ppm Na, 12,400 ppm Ca, pH 5.5, Specific gravity 1.090
6. Reservoir Fracture Pressure:

IV. Geology & Geohydrology, continued

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thick-ness	Character	Chemical Quality
Drift	0ft.	160ft.	sand & gravel	

F. Mineral Resources (oil and gas, coal, brines, etc.)

Small amounts of peat and marl are recovered commercially in the area of the disposal well.

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing: Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface	20 in.	H-40	16 in.		
Intermed.	13 5/8in.	J-55	10 3/4in.	2440ft.	
Injection			2 7/8in.	2550ft.	
Other					

Describe bottom hole completion method: open hole completion

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: 2 - 100,000 gal. storage tanks

1 - 20,000 gal. collection tank

VI. Description of surface equipment

A. Holding tanks & flow lines

B. Filters 2 percent filters

C. Pumps 2 - 150 gpm booster pumps

2 - 150 gpm injection pumps

D. Other

VII. Cores, samples, & logs

A. Coring

From	to	% recovery
"		
"		
"		
"		
"		

B. Drilling logs

Drillers log

X Sample log

Drilling time

X Other lithologic log

VII. -- Cores, samples, & logs, continued

C. Other logs run

X Resistivity	___ Gamma ray-neutron
X SP	___ Temperature
X Caliper	___ Cement bond
X Other Sonic, microlog	

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Waste effluent from metals products operation - waste pickle liquor

B. Physical & chemical Description 0.7% H_2SO_4, 13% FeSO4, 0.5% HCl, 17.4% FeCl, Specific gravity 1.1 to 1.2

C. Volume 130 cu.ft

IX. Pretreatment waste received Filtration to .5 microns

5. Well operation & operating history

A. Tests

Type Injection	Duration	Zones tested	Description of test results
Injection	---	Open hole	12,200 bpd at Gravity

B. Treatments or Stimulation

Zones Treated	Treatment Used	Description of Treatment and Results
Open hole	Acidizing	2,000 gal. of MCA
Open hole	Sulfur Fracturing	---

C. Injection Fluid and Pressure

1. Rate

Date(s) Initial Rate Fluctuations Maximum

2. Previously Drilled Wells (Within ½ Section Mile)

Date(s) Injection Rate Maximum

X. Well operation & operating history

D. Description of operating programs:

E. Operating problems: No problems were reported.

XI. Regulatory aspects.

A. Construction requirements

B. Monitoring requirements

C. Restrictions on operating procedure

XII. Economics

A. Total and unit costs of construction

B. Operating costs

XIII. Source(s) of Information and Published References

Indiana Stream Pollution Control Board

Indiana Geological Survey

WELL FILE NUMBER _____ STATE _____ IN-12 UMR

I. Operating Company & General Well Location

Indiana General Corporation
405 Elm Street
Valparaiso, Indiana

II. Well location (legal description)

Location: Sec. 16, T35N, R5W, Porter County, Indiana

III. History, system planning, construction & operation.

The well was put in operation in 1970.

The well is temporary and will operate only until facilities are installed to evaporate the waste fluid and sell the Dry-Crystal Ammonium Chloride.

IV. Geology & Geohydrology

A. Regional geologic setting: The well is located on the northeast flank of the Kankakee Arch. The regional dip is toward the northeast.

IV. Geology & Geohydrology, continued

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included--yes ____; no X).
(Ground elevation 774 ft.) (Total well depth 4548 ft.)
Datum for depth measurement Ground Level

Name	Age	Depth (top)	Thickness	Lithologic Description
Silurian		440		
Cincinnatian	Ordovician	923		shale
Trenton	Ordovician	1131		limestone
Black River	Ordovician	1397		limestone
Knox	Cambrian	1498		dolomite and shale
Eau Claire	Cambrian	1808		shale
Mt. Simon	Cambrian	2815		sandstone
	Precambrian	4483		crystalline basement

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thickness	Character and Areal Distribution
Mt. Simon	Cambrian	2815 ft.	1668 ft.	sandstone

D. Engineering description of injection units

1. Porosity:
2. Permeability:
3. Original Reservoir Pressure:
4. Reservoir Temperature:
5. Chemical Character of Formation Water: High saline content
6. Reservoir Fracture Pressure:

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality
Drift	0ft.	190ft.	sand & clay	

F. Mineral Resources (oil and gas, coal, brines, etc.)

Peat is mined commercially on a small scale.

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface	20 in.		16 in.	113ft.	
Intermed.	11 3/4in.		10 3/4in.	601ft.	
	9 5/8in.		7 in.	2511ft.	
Injection		Fiberglass	2 7/8in.	2508ft.	

Other Fresh water in annulus

Describe bottom hole completion method: open hole

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: _____

VI. Description of surface equipment

A. Holding tanks & flow lines 10,000 gal. holding tank

B. Filters 2 rotary leaf pressure filters

C. Pumps 10 hp - 50 gpm

D. Other _____

VII. Cores, samples, & Logs

A. Coring

From	to	Recovery

B. Drilling Logs

X Drillers log _____ Drilling time

X Sample log X Other: Lithologic log

VII. -- Cores, samples, & logs, continued

C. Other logs run

___Resistivity
___SP
_X_Caliper
___Other

_X_Gamma ray-neutron
___Temperature
___Cement bond

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Ammonium chloride waste from the manufacture of iron oxide from pickle liquor

B. Physical & chemical Description

C. Volume 10 bbl

IX. Preinjection waste treatment filtration & sedimentation

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results
None			

B. Treatments or stimulations

Zones Treated	Treatment Initial	Description of Treatment and Results
None		

C. Injection rate and pressures

1. Gas

Date(s) [illegible] Average [illegible] Maximum

2. Pressure (well head [illegible] bottom hole [illegible])

Date(s) [illegible] Average [illegible] Maximum

X. Well operation & operating history

D. Description of operating programs:

E. Operating problems: No problems were reported.

XI. Regulatory aspects.

A. Conservation requirements

B. Monitoring requirements [illegible] of operation by state

C. Restrictions on operating procedures

XII. Economics

A. Total and unit costs of construction

a. Operating costs

XIII. Source(s) of information in the preliminary report

Indiana Stream Pollution Control Board

Indiana Geological Survey

WELL FILE NUMBER

STATE

Iowa

I. Operating Company & General Well Location

Cedar Falls Company

Cedar Rapids, Iowa

II. Well location (legal description)

III. History, system planning, construction & operation.

Operation of the well began in 1951. The well was recently put in use in 1957 as a result of disuse of the injection system and has apparently not been used since that time. Abandoned by the Company.

IV. Geology & Hydrology

A. Regional geologic setting:

IV. Geology & Hydrology, continued

B. Hydrology, fresh water aquifers in vicinity

Name	Depth (ft)	Thickness (ft)	Character	Potential Quality
Not known				

F. Oil(gas) Occurrence (oil and gas, coal, water, etc.)

Zone reported to the area

V. Well design and construction

A. Casing, Tubing, and Cement

Hole Size	Casing or Tubing (size & weight)	Depth Set	Type & Amount of Cement
Surface	16 * ??#,		
Intermed. ???,	12 * ???#,		
Intermediate ???,	8 * ???#,		
Intermediate Liner	5 1/2" ???#,		
Plug bottom ???, of 5½, center to stainless steel			
Possible bottom hole completion method: 5 inch open hole 7,??? to 7,??? ft.			

V. [illegible]
A. [illegible]
B. [illegible] [illegible]
[illegible]

VI. [illegible]
A. [illegible]
B. [illegible]
C. [illegible]
D. [illegible]

VII. [illegible]
A. [illegible]
[illegible]
B. [illegible]
[illegible]
[illegible]

VII. -- Cores, samples, & logs, continued

C. Other logs run

____Resistivity ____Gamma ray-neutron

____SP ____Temperature

____Caliper ____Cement bond

____Other _____

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

B. Physical & chemical Description Acetic acid solution (1.5%)

C. Volume

IX. Preinjection waste treatment filtration

X. Well operation & operating history

A. Tests

Type	Duration	Zones Tested	Description of test results
Pumping	4 hrs.	No. Sand	yield 250bbls of brackish water

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results

C. Injection rates and pressures

1. Rate

Date(s) _____ Average _____ Maximum _____

" _____ " _____ " _____

" _____ " _____ " _____

" _____ " _____ " _____

" _____ " _____ " _____

2. Pressure (well head _____ bottom hole _____)

Date(s) _____ Average _____ Maximum _____

" _____ " _____ " _____

" _____ " _____ " _____

" _____ " _____ " _____

" _____ " _____ " _____

X. Well operation & operating history

D. Description of operating programs:

E. Operating problems:

XI. Regulatory aspects.

A. Construction requirements

B. Monitoring requirements

C. Restrictions on operating procedure

XII. Economics

A. Total and unit costs of construction

B. Operating costs

XIII. Source(s) of Information and Published References

Iowa Geological Survey

Quaker Oats Company

WELL FILE NUMBER ~~STATE~~ Yn-1 UNN

I. **Operating Company & General Well Location**

Vulcan Materials Company
(formerly Frontier Chemical Company)
Wichita, Kansas

II. **Well location (legal description)**

Location: 600ft. from the south line and 1065ft. from the west line of the NW 1/4 of Sec. 8, T29S, R1W, Sedgwick County, Kansas

III. **History, system planning, construction & operation.**

Injection began in 1952, the well is reported by the Kansas Health Department to be in use.

IV. Geology & Geohydrology

A. **Regional geologic setting:** Wichita, Kansas, is located in an uplift area between the Anadarko basin on the south and the Salina basin on the north. The north-south trending Nemaha uplift lies just east of Wichita.

IV. Geology & Geohydrology, continued

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included -yes____; no____).

(Ground elevation_____) (Total well depth 400 ft.)

Datum for depth measurement_____

Name	Age	Depth (top)	Thickness	Lithologic Description
Wellington	Permian		240-322'	salt section of the Wellington fm.

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thickness	Character and Areal Distribution
Wellington	Permian	240'		salt section

D. Engineering description of injection units

1. Porosity:_____
2. Permeability:_____
3. Original Reservoir Pressure:_____
4. Reservoir Temperature:_____
5. Chemical Character of Formation Water: Saturated brine
6. Reservoir Fracture Pressure:_____

IV. Geology & Geohydrology, continued

E. Geohydrology, fresh water aquifers in vicinity

Name	Depth	Thick. ness	Character	Chemical Quality

F. Mineral Resources (oil and gas, coal, brines, etc.)

Highly saline natural brines are obtained locally for chemical production.

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing. Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface			8 5/8	240'	138 sacks
Intermed.					cemented to
					surface
Injection					
Other					

Describe bottom hole completion method:

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: _____

VI. Description of surface equipment

A. Holding tanks & flow lines _____

B. Filters _____

C. Pumps _____

D. Other _____

VII. Cores, samples, & Logs

A. Coring

From _____ to _____ Recovery _____

" _____ _____ _____

" _____ _____ _____

" _____ _____ _____

" _____ _____ _____

" _____ _____ _____

B. Drilling Logs

____Drillers Log ____Drilling time

____Sample log ____Other: _____

VII. -- Cores, samples, & logs, continued

C. Other logs run

___Resistivity
___SP
___Caliper
___Other

___Gamma ray-neutron
___Temperature
___Cement bond

VIII. Waste Characteristics

A. Industrial process from which waste is derived

Products of chlorine, sodium hydroxide, and related products from brines of the Wellington Fm.

B. Physical & chemical Description Saturated brines, lime sludge, and waste sodium hydroxide

C. Volume

IX. Preinjection waste treatment None

4. Well operation & operating history

A. Tests

Type	Operation	Zones tested	Description of test results

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results

C. Injection rates and pressures

1. Rate

Date(s) _____ Average 100 - 200gpm Maximum 350gpm

" _____ " _____ " _____

" _____ " _____ " _____

" _____ " _____ " _____

" _____ " _____ " _____

2. Pressure (well head ____ X ____ bottom hole _____)

Date(s) _____ Average Gravity Maximum _____

" _____ " _____ " _____

" _____ " _____ " _____

" _____ " _____ " _____

" _____ " _____ " _____

X. Well operation & operating history

B. Description of operating programs:

E. Operating problems: Pressure control valve plant cooling pipes to rupture in 1961. A shut-off control was installed on the pumps to prevent repetition.

XI. Regulatory aspects.

A. Construction requirements

B. Monitoring requirements

C. Restrictions on operating procedure

III. Economics

A. Type and use value of construction

B. Operating costs

IV. Sources of Information and Literature References

Kansas State Department of Health
Topeka, Kansas

WELL FILE NUMBER STATE Ka-2 UMR

I. Operating Company & General Well Location

Vulcan Materials Company
(formerly Frontier Chemical Company)
Wichita, Kansas

II. Well location (legal description)

Location: Wichita, Kansas, 810 feet from the north line and 1200 feet from the west line of SW 1/4 of Section 27, 28, R1W, Sedgwick County.

III. History, system planning, construction & operation.

Injection began in May 1963. The original well was completed in 1956 and was lost in [illegible] when the well casing collapsed due to corrosion. This well was then plugged with cement. The second well is still in operation.

IV. Geology & Geohydrology

A. Regional geologic setting: Wichita, Kansas, is located in an uplift area between the Anadarko basin on the south and the Salina basin on the north. The north-south trending Nemaha uplift lies just east of Wichita.

IV. Geology & Geohydrology, continued

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included -yes X ; no ___).

(Ground elevation _____) (Total well depth 4,125)

Datum for depth measurement K. B. - 1331'

Name	Age	Depth (top)	Thickness	Lithologic Description
See page 2A				

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thickness	Character and Areal Distribution
Arbuckle	Ordovician	3997	128 (Total drilled)	limestone and dolomite

D. Engineering description of injection units

1. Porosity: _____

2. Permeability: _____

3. Original Reservoir Pressure: Static fluid level 375 feet

4. Reservoir Temperature: _____

5. Chemical Character of Formation Water: Formation fluid is highly mineralized - 150,000 mg/l

6. Reservoir Fracture Pressure: _____

DEPTH FROM	DEPTH TO	NAME OF FORMATION	DESCRIPTION
0	100		Sand and clay
100	410		Shale with gypsum
410	1758		Thin layers of limestone and shale
1758	1794	Severy	Shale and shaley sand
1794	2229	Topeka	Limestone mixed with thin lenses of shale
2229	2238	Heebner Shale	Shale, black, carbonaceous
2238	2240	Lecompton	Limestone, grayish, dense
2240	2264	Snyderville	Shale, gray, green, brown
2264	2288	Toronto	Limestone, brown, with streaks of shale
2288	2495	Douglas	Shale, gray-green, light shaley sand
2495	2654	Lansing	Limestone, tan-brown, with fine grained sand
2654	2997	Kansas City	Shale, gray-green with fine grained sand
2997	3056	Pleasanton	Shale, drab gray, with streaks of limestone
3056	3273	Marmaton	Limestone, cream to brown, slightly chalky
3274	3426	Cherokee	Layers of shale and limestone
3426	3792	Kinderhook	Shale, grayish
3792	3837	Chattanooga	Shale, gray to brownish gray
3837	3927	Simpson	Shale, gray to green with streaks of sand
3927	4125	Arbuckle	Dolomite, tan to dark brown; 88% $CaCO_3$, 12% SiO_2

E. Geohydrology, fresh water aquifers in vicinity

Name	Depth	Thick-ness	Character	Chemical Quality

F. Mineral Resources (oil and gas, coal, brines, etc.)

Oil and gas are produced in the area, and shows of oil were encountered in samples from the interval at 3935 to 3930 feet below the surface. (Kansas City Formation).

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface	15"	3.42#/ft.	10 3/4"	30[illegible]ft.	800sks Pozmix
Intermed.	9"	26#/ft. plastic coated	7 "	3965ft.	1500gal. Gelm
	9"	26#/ft. uncoated	7 "	3965ft.	to 4125ft.
Injection	9"	TK-300 heavy duty	4 1/2"	4125ft.	

Perforation - 3990 to 4115 ft. - 4 jet shots per foot

Other

Describe bottom hole completion method:

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: A Centralizer is located immediately above the perforated zone.

VI. Description of surface equipment

A. Holding tanks & flow lines 407,000 gallon holding pond and surface drainage of rainfall in 300' x 6' drainage ditch. The liquid eventually flows through a 6 inch reinforced polyethelene pipe.

B. Filters

C. Pumps 10"W x 50'L x 12'D pump with 51,300 gal. capacity

D. Other Two automatic throttling valves govern the flow of waste from a pump to the well

VII. Cores, samples, & logs

A. Coring

From	To	Recovery

B. Drilling logs

___Drillers log ___Drilling time

___Sample log ___Other

VII. -- Cores, samples, & logs, continued

C. Other logs run

___Resistivity ___Gamma ray-neutron

___SP ___Temperature

___Caliper ___Cement bond

___Other

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

The waste is derived from the production of chlorine, sodium chloride, and related products

B. Physical & chemical Description Unsaturated Ca and Mg brine solutions, impure bromine, chlorinated organics, and hydrochloric acid. The pH ranges from 1 to 9 during short periods. Average temperature - 120° F

C. Volume 200 - 400 gpm

IX. Preinjection waste treatment

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results
Perforated	Acidized	June 1, 1961 - 2,345 gal.
Zones		HCl
3990-4115		June 3, 1961 - 3,760 gal.
		HCl

C. Injection rates and pressures

1. Rate

Date(s) _____ Average 1.0 gpm Maximum 440 gpm

2. Pressure (well head X bottom hole _____)

Date(s) _____ Average 27 mm of Hg Maximum _____

X. Well operation & operating history

D. Description of operating programs: _____

E. Operating problems: Tubing rupture has occured on four occasions. This is due to a phenomenon called "water hammer" which causes gradual tubing fatigue. Corrosion also supplements the rupture.

XI. Regulatory aspects.

A. Construction requirements _____

B. Monitoring requirements _____

C. Restrictions on operating procedure _____

XII. Economics

A. Total and unit costs of construction $30,000 for drilling and completion. Approximately $40,000 for tubing.

B. Operating costs Maintenance - $25,000 per year.

XIII. Source(s) of Information and Published References

Written communications - Kansas State Department of Health

Donaldson, 1964

WELL FILE NUMBER

Health Dept.
Permit 4108
STATE

Ka-3
UMR

I. Operating Company & General Well Location

National Cooperative Refinery Assoc.
Conway, Kansas

II. Well location (legal description)

Location: NW 1/4, SE 1/4, Sec. 29, T19, R4E, McPherson County, Kansas

III. History; system planning, construction & operation.

Installed in 1952 the well is still in operation and there are no plans for abandonment.

IV. Geology & Geohydrology

A. Regional geologic setting: The well is located on the southern edge of the Salina basin.

IV. Geology & Geohydrology, continued

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included--yes ____; no X).

(Ground elevation _____) (Total well depth 4,225)

Datum for depth measurement _____

Name	Age	Depth (top)	Thickness	Lithologic Description

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thickness	Character and Areal Distribution
Lower Arbuckle	Ordovician	3998'	237' (total drilled)	tan to gray dolomite

D. Engineering description of injection units

1. Porosity: _____
2. Permeability: _____
3. Original Reservoir Pressure: Unknown
4. Reservoir Temperature: _____
5. Chemical Character of Formation Water: _____
6. Reservoir Fracture Pressure: _____

IV. Geology & Geohydrology, continued

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality

F. Mineral Resources (oil and gas, coal, brines, etc.)

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing. Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface			8 5/8"	250	to surface
Intermed.			5 1/2"	3,938	cemented to 480' below ground surface
Injection					
Other					

Describe bottom hole completion method: open hole

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: _____

VI. Description of surface equipment

A. Holding tanks & flow lines 8 Ft. high 10 Ft. diameter redwood settling tank

B. Filters _____

C. Pumps _____

D. Other _____

VII. Cores, samples, & Logs

A. Coring

From _____ to _____ Recovery _____

" _____ _____ _____

" _____ _____ _____

" _____ _____ _____

" _____ _____ _____

" _____ _____ _____

B. Drilling Logs

____Drillers Log ____Drilling time

____Sample log ____Other: _____

VII. [illegible]

E. [illegible]

___Periodicity

___[illegible]

___Polygon

___Other

___[illegible] registration

___Temperature

___[illegible] land

VIII. [illegible]

A. Industries [illegible]

Building of [illegible]

B. Physical & chemical investigation [illegible]

C. Volume [illegible]

IX. [illegible] water [illegible] Time

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results

C. Injection rates and pressures

1. Rate

Date(s) _____ Average 0 to 840 gpm Maximum 840 gpm

" _____ " _____ " _____

" _____ " _____ " _____

" _____ " _____ " _____

" _____ " _____ " _____

2. Pressure (well head _____ bottom hole _____)

Date(s) _____ Average Gravity Maximum _____

" _____ " _____ " _____

" _____ " _____ " _____

" _____ " _____ " _____

" _____ " _____ " _____

X. Well operation & operating history

D. Description of operating programs: _____

E. Operating problems: None

XI. Regulatory aspects.

A. Construction requirements _____

B. Monitoring requirements Five shallow (100') observation wells have been constructed in the area of the well.

C. Restrictions on operating procedure _____

XII. Economics

A. Total and unit costs of construction

B. Operating costs

XIII. Source(s) of Information and Published References

Written communication - Kansas State Department of Health and National Cooperative Refinery Association

WELL FILE NUMBER

Ka-4

I. Operating Company & General Well Location

Shell Oil Company

II. Well location (legal description)

Location: NE 1/4, Sec. 36, T19, R4W, Potter Co., Texas

III. History, system planning, construction & operation.

Installed in 1961 for return of brine solutions resulting from dissolving of salt beds to develop liquid petroleum storage caverns. The well was used primarily during the development phase and is rarely used now.

IV. Geology & Geohydrology

A. Regional geologic setting: The well is located on the southern edge of the Salina basin.

IV. Geology & Geophysics, continued

B. Geologic description of rock units penetrated by well
Rock Unit (Geologic Column included yes___; no X).
(Ground elevation_____) (Total well depth_____)
Datum for depth measurement _____

Name	Age	Depth (top)	Thickness	Lithologic Description

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thickness	Character and Areal Distribution
Arbuckle to Ordovician age				

D. Engineering Description of Injection units

1. Porosity: _____
2. Permeability: _____
3. Original Reservoir Pressure: _____
4. Reservoir Temperature: _____
5. Chemical Character of Formation Water: _____
6. Reservoir Fracture Pressure: _____

IV. Geology & Geohydrology, continued

E. Geohydrology, fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality

V. Mineral Resources (oil and gas, coal, brines, etc.)

VI. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface					
Intermed.					
Injection					
Other					

Describe bottom hole completion method:

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: _____

VI. Description of surface equipment:

A. Holding tanks & flow lines _____

B. Filters _____

C. Pumps _____

D. Other _____

VII. Cores, samples, & logs

A. Coring:

From _____ to _____ %recovery _____

" _____ _____ _____

" _____ _____ _____

" _____ _____ _____

" _____ _____ _____

" _____ _____ _____

B. Drilling logs

___Drillers log ___Drilling time

___Sample log ___Other: _____

_____

VII. -- Cores, samples, & logs, continued

C. Other logs run

___Resistivity
___SP
___Caliper
___Other
___Gamma ray-neutron
___Temperature
___Cement bond

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Saturated solution from solutioning of salt zone to develop storage room

B. Physical & chemical Description Brine solution

C. Volume 3,500 - 17,000 bbl during the development phase

IX. Reinjection waste treatment

X. Well operation & operating history

6.

A. Tests

Type	Duration	Zones tested	Description of test results

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results

C. Injection rates and pressures

1. Rate

Date(s) _____ Average _____ Maximum _____

2. Pressure (well head _____ bottom hole _____)

Date(s) _____ Average _____ Maximum _____

X. Well operation & operating history

D. Description of operating programs:

E. Operating problems:

XI. Regulatory aspects.

A. Construction requirements

B. Monitoring requirements

C. Restrictions on operating procedure

XII. Economics

a. Total and unit costs of construction

b. Operating costs

XIII. Source(s) of Information and Published References

Written communication - Kansas State Department of Health

WELL FILE NUMBER

STATE

Ka-5
UMR

I. Operating Company & General Well Location

Northern ~~National~~ Natural Gas Company, Mullinville, Kansas.

Well approximately 3¼ miles east of Mullinville, Kansas.

II. Well location (legal description)

Location: SE 1/4, Sec. 20, T28, R19W, Kiowa County, Kansas

III. History, system planning, construction & operation.

Installed in 1954 for injection of a brine solution from regeneration of zeolite water softener. The well is still in use. It was unsuccessfully attempted to use the Cheyenne Sandstone for injection in the interval 550 to 750 feet before drilling the well to the Arbuckle Formation at 5500 feet.

IV. Geology & Geohydrology

A. Regional geologic setting: Kiowa County is located on the extreme eastern edge of the Hugoton embayment of the Anadarko basin and on the western flank of the Pratt anticline. The Pratt anticline serves to separate the Sedgwick basin on the east from the Hugoton embayment on the west.

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included -yes___; no_X_).

(Ground elevation 2[illegible]) (Total well depth 6[illegible])

Datum for depth measurement Rotary Table - elev. 2[illegible]

Name	Age	Depth (top)	Thickness	Lithologic Description
Heebner	Penn	4130(-1621)	20'	Shale
Lansing	Penn	4305(-1796)	75'	Limestone & shale
Marmaton	Penn	4730(-2221)	200'	Limestone & shale
Mississippian	Mississippian	4912(-2403)	430'	Limestone
Viola	Ordovician	5342(-3033)	132'	Limestone
Simpson	Ordovician	5474(-3165)	21'	Shale, Limestone & sandstone
Arbuckle	Ordo-Camb	5494(-3185)		Dolomite

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thickness	Character and Areal Distribution
Arbuckle Ls	Ordo-Camb	5500(-3191)	N/A	Basement
Lansing/Kansas City-Missourian		4305(-1796)	425'	Shale/Limestone
Mississippian	Mississippian	4912(-2403)	430'	Limestone
Viola	Ordovician	5342(-3033)	132'	Limestone

D. Engineering description of injection units

1. Porosity:
2. Permeability:
3. Original Reservoir Pressure: (Unknown)
4. Reservoir Temperature: 118° F
5. Chemical Character of Formation Water:

Unknown

6. Reservoir Fracture Pressure:

Unknown

IV. Geology & Hydrology, Minerals 3.

B. Groundwater, Known water bearing formations

Name	Depth	Thickness	Character	Physical Qualities

F. Mineral Resources (all old min. claims, mines, etc.)

V. Well owners and operators

A. Farms, Towns, and Areas

Name of Farm	Name of Owner	Acres	Type & Amount of Power
Surface			
Underground			

Remarks

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: Everseal hook wall packer

VI. Description of surface equipment

A. Holding tanks & flow lines None

B. Filters None

C. Pumps None

D. Other Earthen pond. Surface 82,000 sq. ft. Avg. depth: 3.467 ft. These figures are original engineering data surveyed in 1953.

VII. Cores, samples, & Logs

A. Coring

From _____ to No information Recovery _____

" _____ _____ _____

" _____ _____ _____

" _____ _____ _____

" _____ _____ _____

" _____ _____ _____

B. Drilling Logs

X Drillers Log ___ Drilling time

___ Sample log ___ Other: _____

VII. -- Cores, samples, & logs, continued

C. Other logs run

__x__ Resistivity
____SP
____Caliper
____Other _____

__x__ Gamma ray-[illegible]
____Temperature
____Cement bond

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Regeneration of zeolite water softener

B. Physical & chemical Description Brine solution

Also some iron water from cooling tower

C. Volume 170 - 340 bpd

IX. Preinjection waste treatment

None

I. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results
		None	

B. Treatments or Stimulation

Zones Treated	Treatment Used	Description of Treatment and Results
	None	

C. Injection rates and pressures (maximum)

1. Rate

Date(s)	Average	Maximum

2. Pressure (well head _____ bottom hole _____)

Date(s)	Average	Gravity	Maximum

X. Well operation & operating [illegible]

D. Description of operating procedures

[redacted]

E. Operating problems

[redacted]

XI. Regulatory aspects

A. Construction requirements

[redacted]

B. Monitoring requirements

[redacted]

C. Restrictions on operating procedures

[redacted]

I. Economics

A. Total and unit costs of construction _____

b. Operating costs _____

II. Source(s) of Information and Published References. _____

Written communication - Fresno State Department of Health and Northern Natural Gas Company

WELL FILE NUMBER

STATE

Ka-1
CNR

I. Operating Company & General Well Location
Northern Natural Gas Pipeline Co.
Beehive Compressor

II. Well location (legal description)
Location: NE 1/4, Sec. 5, T10S, R6W, Rice County

III. History, system planning, construction & operation.
Injection began - February 19, 1954
Drilled in 1952 into Cheyenne sandstone (550'-750'), but
Arbuckle not successful as a disposal system, so the
well was deepened to the Arbuckle in 1954.

IV. Geology & Geohydrology
A. Regional geologic setting: Rice County is on the Central
Kansas uplift southeast of the Salina basin.

IV. Geology & Hydrology, continued

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included yes___, no___).

(Ground elevation_____) (Total well depth 5413 ft.)

Datum for depth measurement_____

Name	Age	Depth (top)	Thickness	Lithologic Description
Arbuckle	Ordovician	3,304	108 (total drilled)	limestone

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thickness	Character and Areal Distribution

D. Engineering description of injection units

1. Porosity:_____
2. Permeability:_____
3. Original Reservoir Pressure:_____
4. Reservoir Temperature:_____
5. Chemical Character of Formation Water:_____
6. Reservoir Fracture Pressure:_____

IV. Geology & Geohydrology, continued 3.

E. Geohydrology, fresh water aquifers in vicinity

Name	Depth	Thick-ness	Character	Chemical Quality

F. Mineral Resources (oil and gas wells, brine, etc.)

Oil and gas are produced in the area.

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing Weight & Grade	Size	Depth Set	Type & Amount of Cement
Surface					
Intermed.					
Injection					
Other					

Describe bottom hole completion method:

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: _____

VI. Description of surface equipment

A. Melting tanks & flow lines Small concrete holding pit siphon from pit to well bore to recharge air

B. Filters _____

C. Pumps _____

D. Other _____

VII. Cores, samples, & logs

A. Coring

From	to	Recovery
-		
-		
-		
-		
-		

B. Drilling logs

___Drillers log ___Drilling time

___Sample log ___Other: _____

VII. -- Cores, samples, & logs, continued

C. Other logs run

___Resistivity
___SP
___Caliper
___Other

___Gamma ray-neutron
___Temperature
___Cement bond

VIII. Waste Characteristics

A. Industrial process from which waste is derived

B. Physical & chemical Description: Brine solution from backwashing of a textile water softening unit

C. Volume

IX. Preinjection waste treatment: Removal of chromium and pH adjustment

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results

C. Injection rates and pressures

1. Rate

Date(s) _____ Average 170 bpd Maximum _____

" _____ " _____ " _____

" _____ " _____ " _____

" _____ " _____ " _____

" _____ " _____ " _____

2. Pressure (well head X bottom hole _____)

Date(s) _____ Average Gravity Maximum _____

" _____ " _____ " _____

" _____ " _____ " _____

" _____ " _____ " _____

" _____ " _____ " _____

X. Well operation & operating history

D. Description of operating programs: _____

E. Operating problems: _____

XI. Regulatory aspects.

A. Construction requirements _____

B. Monitoring requirements _____

C. Restrictions on operating procedure _____

XII. Economics

A. Total and unit costs of construction

B. Operating costs

XIII. Source(s) of Information and Published References

Written communication - Kansas State Department of Health

[redacted]

I. [redacted]

II. [redacted]

III. [redacted]

IV. [redacted]

IV. Geology & Hydrology, continued

3.

B. Geohydrology: fresh water aquifers in vicinity

Depth.

Name	Depth	Thickness	Character	Content & quality
Quite few water wells are found surrounding to area in depth of from 15' to 100'. Water is usable.				

C. Mineral Resources (oil and gas, coal, metals, etc.)

Oil and gas from 3000' in Atlantic formation.

V. Well design and construction.

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing: Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface	17½"	48# new	13-3/8"	350'	350 sx
Intermed.	12¼"	32.75# H40	9-5/8"	1200'	1200 sx
Production	8-3/4"		7"	4100'	1800 sx

Other

Describe bottom hole completion method: Drilled with rotary. Set at 4100' drive pipe 100' 20".

VII. -- Power, engine, & gas, equipment

C. Other gas men

___Intensity

___Ac

___Caliper

___Plane

___Power requirement

___Temperature

___Power head

VIII. Note Characteristics

A. Industries trading for which tests to derive

B. Purpose & control situation

C. Volume

IX. Publication note treatment

XII. Remarks

a. Total and unit costs of construction

Approximately $50,000.

b. Operating costs $800 per year.

XIII. Source(s) of Information and Published References

Written communications - Kansas State Department of Health

Shell Oil Corporation

Oklahoma City, Oklahoma

WELL FILE NUMBER

STATE

Ks-8

I. Operating Company & General Well Location

Colorado Interstate Gas Company

Elkhart Compressor Station, Kansas

II. Well location (legal description)

Location: NE 1/4, Sec. 15, T33S, R41W, Morton County

III. History, system planning, construction & operation.

Injection commenced: late 1967

The well was installed in 1957, and is still in use.

IV. Geology & Geohydrology

A. Regional geologic setting: Morton County is in the extreme northwest corner of the Anadarko basin. Consolidated rocks in the area range from Ordovician to Cretaceous in age. Cretaceous rocks are overlain by the Tertiary age Ogallala Formation.

IV. Geology & Geohydrology, continued 2.

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included yes___; no X).

(Ground elevation_____) (Total well depth 1,272)

Datum for depth measurement_____

Name	Age	Depth (top)	Thick-ness	Lithologic Description
Glorietta		1065		sandstone

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thick-ness	Character and Areal Distribution
Glorietta		1065		widespread blanket sandstone

D. Engineering description of injection units

1. Porosity:_____
2. Permeability:_____
3. Original Reservoir Pressure:_____
4. Reservoir Temperature:_____
5. Chemical Character of Formation Water:_____
6. Reservoir Fracture Pressure:_____

IV. Geology & Geohydrology, continued

E. Geohydrology, fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality
Ogallala			Tertiary age sands, gravels, and clays	fresh

F. Mineral Resources (oil and gas, coal, brines, etc.)

Extensive oil and gas reservoirs occur in the area.

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing Weight & Grade	Size	Depth Set	Type & Amount of Cement
Surface					
Intermed.					
Injection	6 3/4in.	[illegible] J-55	4 1/2in.	1270	275 sacks
Other					

Describe bottom hole completion method:

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: _____

VI. Description of surface equipment

A. Holding tanks & flow lines _____

B. Filters _____

C. Pumps _____

D. Other _____

VII. Cores, samples, & Logs

A. Coring

From _____ to _____ Recovery _____

" _____ _____ _____

" _____ _____ _____

" _____ _____ _____

" _____ _____ _____

" _____ _____ _____

B. Drilling Logs

____Drillers Log

____Sample log

____Drilling time

____Other: _____

VII. -- Cores, samples, & logs, continued

C. Other logs run

X Resistivity - laterlog
X Gamma ray-neutron
SP
Temperature
Caliper
Cement bond
Other

VIII. Waste Characteristics

A. Industrial Process from which waste is derived
Regeneration of resin in a de-alkalizer unit

B. Physical & chemical Description Brine solution and rinse water

C. Volume

IX. Preinjection waste treatment

Plant wastes:
Boiler water is recirculated; sanitary wastes are piped to stabilization pond; wastes containing petroleum products are placed in burn pit.

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results

C. Injection rates and pressures

1. Rate

Date(s)	Average	120 to [illegible]	Maximum
"	"	"	"
"	"	"	"
"	"	"	"
"	"	"	"

2. Pressure (well head _____ ; bottom hole _____)

Date(s)	Average	Gravity	Maximum
"	"	"	"
"	"	"	"
"	"	"	"
"	"	"	"

I. Well operation & monitoring history

B. Description of operating programs: _____

E. Operating problems: Reports operating satisfactorily to date, 1/81

II. Regulatory aspects.

A. Construction Requirements _____

B. Monitoring requirements _____

C. Restrictions on resulting groundwater _____

XII. Economics

A. Total and unit costs of construction

B. Operating costs

XIII. Source(s) of Information and Published References

Written Communication - Kansas State Department of Health and Colorado Interstate Gas Co.

WELL FILE NUMBER

I. Operating Company & General Well Location

Amoco Production Company

Ulysses Gasoline Plant

II. Well location (legal description)

Location: NE 1/4, Sec. 5, T32S, R38W, Grant County

McCannon Disposal Well No. 2 - 660' S of N & 1070' W of E

Lines; Also have SWD No. 1 at plant but handles only brine, no industrial waste.

III. History, system planning, construction & operation.

Until 1956, the wastewater was discharged to evaporation ponds. The well was completed May 5, 1958, and injection was began in 1958. Encountered some problems with lost circulation and fishing during drilling. Also experienced considerable formation plugging during first 18 months' operation, requiring well reworks. Installed filters on injection stream and reduced formation plugging problems. Well is still in operation.

IV. Geology & Geohydrology

A. Regional geologic setting: Grant County is located in the northwest portion of the Anadarko Basin. Consolidated rocks range in age from Ordovician to Cretaceous, and are overlain by unconsolidated Tertiary age deposits.

IV. Geology & Geohydrology, continued 2.

B. Geologic description of rock units penetrated by well
Rock Unit (Geologic Column included -yes ___; no X).
(Ground elevation 3149') (Total well depth 3950ft.)
Datum for depth measurement _____

Name	Age	Depth (top)	Thick-ness	Lithologic Description
Ogallala	Tertiary	Surface	460ft.	
	Cretaceous			
Cimarron Salt Sect.	Wolfcamp.	1690	60ft.	
Hugoton Gas Pay	"	2388	212ft.	
Council Grove Lime	"	2730	160ft.	
Topeka Lime	Virgil	3400	370ft.	

C. Geologic Description of injection units & possible units not in use

Rock Unit Name	Age	Depth (top)	Thick-ness	Character and Areal Distribution
*Lansing		3992	450'	Thin stringers separated by shale
Topeka		3400	370'	limestone

Note: The Lansing zone is used as both salt water source and disposal zone in McGannon No. 1 SWD well listed on page 1, but was not penetrated in subject well

D. Engineering description of injection units

1. Porosity: 12-16%
2. Permeability: _____
3. Original Reservoir Pressure: est. 840 psi
4. Reservoir Temperature: 88F.
5. Chemical Character of Formation Water: Not accurately determined--only Topeka water sample obtained believed to be contaminated by filtrate during drilling operations, however, chlorides are at least 25,200ppm and total solids are 44,600 ppm by analysis of available water samples.
6. Reservoir Fracture Pressure: 1700psi (breakdown on acidizing)

IV. Geology & Geohydrology, continued

E. Geohydrology, fresh water aquifers in vicinity

Name	Depth	Thick-ness	Character	Chemical Quality
Ogallala	400	45'	Coarse sand - prolific	Excellent - used for domestic and irrigation purposes throughout area.

F. Mineral Resources (oil and gas, coal, brines, etc.)

Gas production from Hugoton per listed on page 1.

i.e. Herington-Krider - top 2780'

Winfield 2830'

Towanda 2913'

Ft. Riley 3570'

Brine production from Lansing zone in adjacent McCannon SWD Well No. 1 (not penetrated in subject well).

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing: Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface	12-1/4"	23.7# Armco ST	8-5/8"	623'	300 sx circ. to sfc.
Intermed.	7-7/8"	9.5# J55 STLS	4-1/2"	3939'	1600 sx - DV tool @ 2116' - 1000 sx
Injection	Down 4-1/2" casing -(no tubing in well)				
Other					

Describe bottom hole completion method: Perf. 3514-24', 3536-41', 3803-13', with 6 SPF. Acd w/750 gal 15% HCL (see Section X for subsequent repairs and re-perforations).

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: _____

Centralizers at 1051', 1171', 1211', 1251', 1292', 1331' (on casing or packer)

Wellhead - 4.' to 2" casing nipp with 2" I

VI. Description of surface equipment

A. Holding tanks & flow lines 10' x 12' dia. 200 barrel - 2" int. line from holding tank to well.

B. Filters Use two 3' x 4' dia. Permutit filters packed with graded (#1-6) anthrafiltr filter bed topped with preformed floc composed of alum and soda ash to improve filter efficiency.

C. Pumps 1 - Frank Wheatley 5-WD centrifugal - with 10 HP motor.

D. Other None

VII. Cores, samples, & Logs

A. Coring None

From _____ to _____ Recovery _____

" _____ _____ _____

" _____ _____ _____

" _____ _____ _____

" _____ _____ _____

" _____ _____ _____

B. Drilling Logs

X Drillers Log

____ Sample log

____ Drilling time

____ Other: _____

VII. -- Cores, samples, & logs, continued

C. Other logs run

X Resistivity	___ Gamma ray-neutron
X SP	___ Temperature
___ Caliper	___ Cement bond
X Other Lane Wells Perforating Formation Collar Chart	

VIII. Waste Characteristics

A. Industrial Process from which waste is derived 3 colling towers serving heat exchanges in hydrocarbon extraction plant.

B. Physical & chemical Description Coolong water containing hexavalent chromium

C. Volume 0-1500 bpd

IX. Preinjection waste treatment filter through two Permutit filters listed above.

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results
v. 1960 Injectivity*	1 hr, 47 min	All Topeka perfs listed below.	Inj 300 gpm @ 43 psig

*Note: This is last known injectivity test--well began taking 1000 BPD on vacuum within 2 weeks after above test. Well currently takes normal injection rates on vacuum.

B. Treatments or Stimulation (all prior to November, 1960)

Zones Treated	Treatment Method	Description of Treatment and Results
Original completion interval (see Page 2)	Acidized	1000 gal 15% HCL, no relief to pluggin
Reperfed 3748-56' (4 SPF)	Acidized	1000 gal 15% retarded HCL-plugging relieved 6 mo
All perfs.	Acidized	1500 gal 15% retarded HCL-plugging no relief to
Reperfed 3516-19', 3538-40', 3564-68', 3750-52', 3744-52', 3617-22' and 3582-86'	Fracture (4 stage)	100,000 gal H_2O, 100,000# sand-plugging relieved
	Acidized	4000 gal 15% HCL

C. Injection rates and pressures

1. Rate

Date(s) 5-5-58 (on completion) Average _____ Maximum 2.05 BPM (2950 B

" _____ " _____ "

" _____ " _____ "

" _____ " _____ "

" _____ " _____ "

2. Pressure (well head 20" vacuum bottom hole _____)

Date(s) _____ Average _____ Maximum _____

" _____ " _____ "

" _____ " _____ "

" _____ " _____ "

" _____ " _____ "

X. Well operation & operating history

D. Description of operating programs: primarily involved periodic formation plugging during first 2 years' operation as described above. Situation improved by filtering water.

E. Operating problems: Currently - none

XI. Regulatory aspects.

A. Construction requirements Must protect fresh water zone

B. Monitoring requirements None

C. Restrictions on operating procedure Limited to gravity injection on Kansas State permit No. 6216 covering discharge of industrial waste into well.

XII. Economics

A. Total and unit costs of construction $39,000 initial well investment--approximately $12,000 subsequent repair costs.

B. Operating costs Negligible (plant generators supply electricity for motor on disposal pump when needed)

XIII. Source(s) of Information and Published References

Written communication - Kansas State Department of Health

Amoco Production COmpany

WELL FILE NUMBER — KANSAS STATE — Ks-10 UIC

I. Operating Company & General Well Location

Derby Refining Co. (owner)

Colorado Oil Company (operator)

(Each of these companies is a division of Colorado Oil and Gas Corporation)

II. Well location (legal description)

Location:

675 feet from south line; 865 feet from east line, Section 4, Township 27 South, Range 1 East; Sedgwick County, Kansas

III. History; system planning, construction & operation.

Installed in 1957

Well is a directional hole. TVD 3880 feet. Bottom Hole Location, 539.5 feet North & 1,255.5 feet West of Surface Location.

Original completion involved injection down casing. Tubing to below water level was added in late 1960 to prevent corrosion at the air-water interface.

Initial use was for disposal of spent caustic from refinery operation, but since early 1959 only oil field brine has been injected, as refinery converted to a water treatment system that permitted sewer disposal.

IV. Geology & Geohydrology

A. Regional geologic setting: Located in Sedgwick Basin, on west flank of an anticline.

IV. Geology & Geohydrology, continued

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included--yes ____; no X).

(Ground elevation 1310) (Total well depth 3899 TVD)

Datum for depth measurement 1316 KB

Name	Age	Depth (top)	Thickness	Lithologic Description
Lansing	Penn.	2515 TVD		ls - sh
Mississippian	Miss.	2981		ls
Viola	Ord.	3317		Dol.
Simpson	Ord.	3352		ss - sh
Arbuckle	Ord.	3415		Dol.

This well was directionally drilled. Depths reported are true vertical depths.

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thickness	Character and Areal Distribution
Arbuckle ls	Ordovician	3415	484ft.	Blanket porous Dolomite

D. Engineering description of injection units

1. Porosity: Unknown
2. Permeability: Unknown
3. Original Reservoir Pressure: Not measured - Estimate 1300#
4. Reservoir Temperature: Not measured
5. Chemical Character of Formation Water: Salt water
6. Reservoir Fracture Pressure: Not fractured

IV. Geology & Geohydrology, continued

E. Geohydrology, fresh water aquifers in vicinity

Name	Depth	Thick-ness	Character	Chemical Quality

F. Mineral Resources (oil and gas, coal, brines, etc.)

Located on west side of an oil field which produces from Lansing, Viola and Simpson

V. Well design and construction

A. Casing, Tubing and Cement

	Hole Size	Casing or Tubing Weight & Grade	Size	Depth Set	Type & Amount of Cement
Surface	11-3/4"	[illegible]	[illegible]	xxx	225 sx pozmix (cement to surf.)
Intermed.					
Injection or	[illegible]	[illegible]	[illegible]	1230	150 sx pozmix & 50 sx cement
Other					

Describe bottom hole completion attempt: Spud hole 12¼", 4 7/8" drilled 9-jack hole to 4,0[illegible], Cemented 7-inch casing to 3[illegible], Cleaned out with 6 1/8" rock bit to 4,0[illegible], Treated with 1,000 gal. HCl and acid. Swabbed back. Treated with 6,000 gal HCl acid. Initial input rate across acid pit - 6 BPM.

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: [illegible]

[illegible]

VI. Description of surface equipment

A. Holding tanks & flow lines [illegible]

B. Filters None

C. Pumps None

D. Other [illegible]

VII. Cores, samples, & logs

A. Coring

From	To	Recovery
"		
"		
"		
"		
"		

B. Drilling logs

X Drillers log ___ Drilling time

X Sample log ___ Other: ___

C. Other Inspection

___Permeability
___pH
___Salinity
___Other ___Specify

___Gamma ray-neutron
___Temperature
___Cement bond

VIII. Waste Characterization

A. Industrial Process from which waste is derived

Extraction, purification, recirculation, and chemical treatment of brine for use in the chlor-alkali industry to produce chlorine, caustic soda, and hydrogen.

B. Physical & Chemical Property of ___Solid, Liquid, or Gaseous

Solid waste will consist of brine sludge, consisting primarily of calcium carbonate, magnesium hydroxide, and calcium sulfate. Brine sludge will have been washed with fresh water prior to disposal.

C. Volume ___Solid: 4,000 tons

IX. Protection of Underground Sources of Drinking Water

Practically, injection of the solid waste will be separated from drinking water by several thousand feet of impermeable rock. Geological data will also indicate that the injection zone is isolated from any freshwater.

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results
DST	One hour	Viola	30' oil, 2245' water
"	" "	Simpson	60' Oil, 65' OCM
"	" "	"	60' Mud
"	" "	"	140' Muddy Sulphur Water
"	" "	Arbuckle	265' Muddy Sulphur Water

B. Treatments or Stimulation

	Zones Treated	Treatment Method	Description of Treatment and Results
tial	4204-3750	Pumped down 7-in. csg.	1000 gal 15% MCA, followed by 8000 gal. 15% HCL
57	4204-3750	" " " "	3000 gal 15% HCL
ol	4204-3750	Cleaned out scale & caustic 400 ft - 3860 ft. & backflowed well by swabbing	
63	4204-3750	Pumped down 7-in. csg.	2000 gal. 15% HCL

C. Injection rates and pressures

1. Rate

Date(s)	Average	Maximum	
" 12/57	" 3 BPM	"	Before acid job abo
" 12/57	" 6 BPM	"	After acid job abo
" 12/61	" 6 BPM	"	After cleanout
"	"	"	

2. Pressure (well head X bottom hole)

Date(s)	Average Gravity	Maximum	
"	"	"	
"	"	"	
"	"	"	
"	"	"	

X. Well operation & operating history

D. Description of operating programs:

E. Operating problems:

Periodic plugging of well with reduction in injection rate. Corrected by periodic acid jobs and clean out. Problems less since refinery waste no longer injected.

XI. Regulatory aspects.

A. Construction requirements Protect fresh water aquifers with casing

B. Monitoring requirements None

C. Restrictions on operating procedure None

XII. Economics

A. Total and unit costs of construction

Approximate cost of drilling and completing	$45,822
Approximate cost of well equipment	11,919
	$57,741

B. Operating costs None

XIII. Source(s) of Information and Published References

Written communication - Kansas State Department of Health

Colorado Oil Company

WELL FILE NUMBER

STATE

Ka-11
UMR

I. **Operating Company & General Well Location**

Cities Service Oil Company

II. **Well location (legal description)**

Location: SW 1/4, Sec. 22, T23, R6W, Reno County, Kansas

III. **History, system planning, construction & operation.**

1st Well installed in 1958, apparently still used.

IV. Geology & Geohydrology

A. Regional geologic setting: Reno County lies between the Anadarko basin on the southwest and the Salina basin on the northeast.

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included - yes ____; no X).

(Ground elevation _____) (Total well depth _____)

Datum for depth measurement _____

Name	Age	Depth (top)	Thick-ness	Lithologic Description

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thick-ness	Character and Areal Distribution
Arbuckle Ls		±4000'		

D. Engineering description of injection units

1. Porosity: _____
2. Permeability: _____
3. Original Reservoir Pressure: _____
4. Reservoir Temperature: _____
5. Chemical Character of Formation Water: _____
6. Reservoir Fracture Pressure: _____

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thick-ness	Character	Chemical Quality

F. Mineral Resources (oil and gas, coal, brines, etc.)

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing. Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface					
Intermed.					
Injection					
Other					

Describe bottom hole completion method:

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: _____

VI. Description of surface equipment

A. Holding tanks & flow lines _____

B. Filters _____

C. Pumps _____

D. Other _____

VII. Cores, samples, & Logs

A. Coring

From _____ to _____ Recovery _____

" _____ _____ _____

" _____ _____ _____

" _____ _____ _____

" _____ _____ _____

" _____ _____ _____

B. Drilling Logs

____Drillers Log ____Drilling time

____Sample log ____Other: _____

_____

VII. -- Cores, samples, & logs, continued

C. Other logs run

___Resistivity	___Gamma ray-neutron
___SP	___Temperature
___Caliper	___Cement bond

___Other_____

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Solutioning of salt zone for storage of LP gas.

B. Physical & chemical Description Brine solution

C. Volume 0-30,000 bbl

IX. Preinjection waste treatment

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results

C. Injection rates and pressures

1. Rate

Date(s)	Average	Maximum

2. Pressure (well head ___X___ bottom hole _____)

Date(s)	Average Gravity	Maximum

X. Well operation & operating history

D. Description of operating programs: _____

E. Operating problems: None

XI. Regulatory aspects.

A. Construction requirements _____

B. Monitoring requirements _____

C. Restrictions on operating procedure _____

XII. Economics

A. Total and unit costs of construction

B. Operating costs

XIII. Source(s) of information and Pertinent References.

Written communication - Kansas State Department of Health

Clinic Service (1) (copy was also received, but did not

provide further information.

WELL FILE NUMBER

Prior

Ks-12

I. Operating Company & General Well Location

Cities Service Oil Company

II. Well location (legal description)

Location: SW 1/4, SEC. 22, T23, R6W, Reno County, Kansas

III. History, system planning, construction & operation.

Test well - Installed in 1957, presently still used.

IV. Geology & Hydrology

A. Regional geologic setting: See Ks-11

B. Geologic description of rock units penetrated by well
Rock Unit (Geologic column included yes___; no_X_).
(Ground elevation_____) (Total well depth_____)
Datum for depth measurement_____

Name	Age	Depth (top)	Thickness	Lithologic Description

C. Geologic description of injection units & possible units not in use

Name	Age	Depth (top)	Thickness	Character and Areal Distribution
Arbuckle is				

D. Engineering description of injection units
1. Porosity:_____
2. Permeability:_____
3. Original reservoir pressure:_____
4. Reservoir temperature:_____
5. Chemical character of formation water:_____
6. Reservoir fracture pressure:_____

IV. Geology & Geohydrology, continued

E. Geohydrology, fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality

F. Mineral resources (oil and gas, coal, brines, etc.)

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface					
Intermed.					
Injection					
Other					

Describe bottom hole completion method:

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: _____

VI. Description of surface equipment

A. Holding tanks & flow lines _____

B. Filters _____

C. Pumps _____

D. Other _____

VII. Cores, samples, & logs

A. Coring

From _____ to _____ Recovery _____

" _____ _____ _____

" _____ _____ _____

" _____ _____ _____

" _____ _____ _____

" _____ _____ _____

B. Drilling logs

___Drillers log

___Sample log

___Drilling time

___Other: _____

VII. -- Cores, samples, & logs, continued

C. Other logs run

____Resistivity ____Gamma ray-neutron

____SP ____Temperature

____Caliper ____Cement bond

____Other_____

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Solutioning of salt zone for LP gas storage

B. Physical & chemical Description Brine solution

C. Volume 0 - 30,000 bpd

IX. Preinjection waste treatment

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results

C. Injection rates and pressures

1. Rate

Date(s)	Average	Maximum
"	"	"
"	"	"
"	"	"
"	"	"

2. Pressure (well head _____ bottom hole _____)

Date(s)	Average	Maximum
"	"	"
"	"	"
"	"	"
"	"	"

X. Well operation & operating history

D. Description of operating programs: _____

E. Operating problems: None

XI. Regulatory aspects.

A. Construction requirements _____

B. Monitoring requirements _____

C. Restrictions on operating procedure _____

XII. Economics

A. Total and unit costs of construction

B. Operating costs

XIII. Source(s) of Information and Published References

Written Communications - Kansas State Department of Health

Cities Service Oil Company was also contacted, but did not provide further information.

WELL FILE NUMBER _____ STATE Ka-13 UMR

I. Operating Company & General Well Location

Cities Service Oil Company

3 Wells

II. Well location (legal description)

Location: SW 1/4, Sec. 22, T23, R6W, Reno County, Kansas.

III. History, system planning, construction & operation.

3rd well - Installed in 1968, apparently still used.

IV. Geology & Geohydrology

A. Regional geologic setting: See Ka-11

IV. Geology & Geohydrology, continued

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included--yes____; no X).

(Ground elevation_____) (Total well depth_____)

Datum for depth measurement_____

Name	Age	Depth (top)	Thickness	Lithologic Description

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thickness	Character and Areal Distribution
Arbuckle Ls		±9000'		

D. Engineering description of injection units

1. Porosity:_____
2. Permeability:_____
3. Original Reservoir Pressure:_____
4. Reservoir Temperature:_____
5. Chemical Character of Formation Water:_____
6. Reservoir Fracture Pressure:_____

IV. Geology & Geohydrology, continued

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thick-ness	Character	Chemical Quality

F. Mineral Resources (oil and gas, coal, brines, etc.)

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing. Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface					
Intermed.					
Injection					
Other					

Describe bottom hole completion method:

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: _____

VI. Description of surface equipment

A. Holding tanks & flow lines _____

B. Filters _____

C. Pumps _____

D. Other _____

VII. Cores, samples, & Logs

A. Coring

From _____ to _____ Recovery _____

" _____ _____ _____

" _____ _____ _____

" _____ _____ _____

" _____ _____ _____

" _____ _____ _____

B. Drilling Logs

___Drillers Log ___Drilling time

___Sample log ___Other: _____

VII. -- Cores, samples, & logs, continued

C. Other logs run

____Resistivity ____Gamma ray-neutron

____SP ____Temperature

____Caliper ____Cement bond

____Other _____

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Solutioning of salt zone for LP gas storage

B. Physical & chemical Description Brine solution

C. Volume 0 - 30,000 bpd

IX. Preinjection waste treatment

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results

C. Injection rates and pressures

1. Rate

Date(s)	Average	Maximum
"	"	"
"	"	"
"	"	"
"	"	"

2. Pressure (well head ____X____ bottom hole _____)

Date(s)	Average Gravity	Maximum
"	"	"
"	"	"
"	"	"
"	"	"

X. Well operation & operating history

D. Description of operating programs: _____

E. Operating problems: None

XI. Regulatory aspects.

A. Construction requirements _____

B. Monitoring requirements _____

C. Restrictions on operating procedure _____

XII. Economics

A. Total and unit costs of construction

B. Operating costs

XIII. Source(s) of Information and Published References

Written communications - Kansas State Department of Health

Cities Service Oil Company was also contacted, but did not provide further information.

WELL FILE NUMBER [redacted] STATE [redacted] Ka-14 CWR

I. Operating Company & General Well Location

Tuloma Gas Products Company

II. Well location (legal description)

Location: NW 1/4, Sec. 14, T24, R6W, Reno County, Kansas

III. History, system planning, construction & operation.

Installed in 1958, apparently still used.

IV. Geology & Geohydrology

A. Regional geologic setting: Reno County is located between the Anadarko basin on the south and the Salina basin on the north.

IV. Geology & Geohydrology, continued

B. Geologic description of rock units penetrated by well
Rock Unit (Geologic Column included -yes___; no X).
(Ground elevation_____) (Total well depth_____)
Datum for depth measurement:_____

Name	Age	Depth (top)	Thickness	Lithologic Description

C. Geologic Description of injection units & possible units not in use
Rock Unit:

Name	Age	Depth (top)	Thickness	Character and Areal Distribution
Arbuckle Lm.	Ordovician	4100'		limestone, occurs regionally

D. Engineering description of injection units
1. Porosity:
2. Permeability:
3. Original Reservoir Pressure:
4. Reservoir Temperature:
5. Chemical Character of Formation Water:
6. Reservoir Fracture Pressure:

IV. Geology & Geohydrology, continued

E. Geohydrology, fresh water aquifers in vicinity

Name	Depth	Thick-ness	Character	Chemical Quality

F. Mineral Resources (oil and gas, coal, brines, etc.)

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing: Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface					
Intermed.					
Injection					
Other					

Describe bottom hole completion method:

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: _____

VI. Description of surface equipment

A. Holding tanks & flow lines _____

B. Filters _____

C. Pumps _____

D. Other _____

VII. Cores, samples, & logs

A. Coring

From	to	Recovery

B. Drilling logs

___Drillers Log ___Drilling time

___Sample log ___Other: _____

_____

VII. -- Cores, samples, & logs, continued

C. Other logs run

___Resistivity
___SP
___Caliper
___Other

___Gamma ray-neutron
___Temperature
___Cement bond

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Solutioning of salt zone for LP gas storage

B. Physical & chemical Description Brine solution

C. Volume 0-2,000 bbl

IX. Preinjection waste treatment

X. Well operation & operation history

A. Tests

Type	Duration	Zones tested	Description of test results

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results

C. Injection rates and pressures

1. Rate

Date(s)	Average	Maximum

2. Pressure (well head ____ X ____ bottom hole ____)

Date(s)	Average	Gravity	Maximum

X. Well operation & operating history

D. Description of operating programs:

E. Operating problems: None

XI. Regulatory aspects.

A. Construction requirements

B. Monitoring requirements

C. Restrictions on operating procedure

XII. Economics

A. Total and unit costs of construction

b. Operating costs

XIII. Source(s) of information and Pertinent References.

Written communication - Kansas State Department of Health

Tulsa Gas Products Company was also contacted, but did not respond.

WELL FILE NUMBER ~~Kansas Geol. Survey~~ Ka-15 ~~UNK~~

I. Operating Company & General Well Location

Shelly Oil Company - Kansas Pip. Line Division
1 mile east - 2 miles south of Burton, Kansas at
Shelly's Pipe Line pumping station.

II. Well location (legal description)

Location: SW 1/4, Sec. 36, T22, R3W, Harvey County, Kansas

III. History, system planning, construction & operation.

Installed in 1948 - Drilled for purpose of disposing of brines which settle to bottom of tank from crude oil storage. Its operation ceased in 1964 by order of the Kansas State Board of Health.

IV. Geology & Hydrology

A. Regional geologic setting: Harvey County is located between the Arkansas basin on the south and the Salina basin on the north.

B. Geologic description of rock units penetrated by well
Rock Unit (Geologic Column Included yes___; no X).
(Ground elevation_____) (Total well depth 937')
Datum for depth measurement_____

Name	Age	Depth (top)	Thick-ness	Lithologic Description

C. Geologic description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thick-ness	Character And Areal Distribution
Wellington Formation	Ord.	937'	8½	

lost circulation zone from 918-937 feet used for disposal

D. Engineering description of injection units
1. Porosity:
2. Permeability:
3. Original Reservoir Pressure:
4. Reservoir Temperature:
5. Chemical Character of Formation Water:
6. Reservoir Fracture Pressure:

IV. Geology & Geohydrology, continued

K. Geohydrology, fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality

V. Mineral Resources (oil and gas, coal, brines, etc.)

VI. Well Design and Construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing Size, Weight & Grade	Depth Set	Type & Amount of Cement
Surface	12 1/4"	8 5/8" O.D. Grade B	8 4/8"OD 275.61'	
Intermed.	7 7/8"	Casing Seamless	5 1/2"OD 913.01'	17 sax Maccogel 5 sax Lime
Injection		2 1/8" Tubing-Seamless	2 3/8"OD 915'	
Other				

Describe bottom hole completion method: Packer at 913'. Tubing through packer. Casing cemented top to bottom.

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc:

VI. Description of surface equipment

A. Holding tanks & flow lines 250 bbl. brine holding tank.
High Pressure pump - 10 BPH at 350 PSI
Powered by 5 H. P. elec. motor.

B. Filters

C. Pumps

D. Other

VII. Cores, samples, & Logs

A. Coring

From _____ to _____ Recovery _____
" _____ _____ _____
" _____ _____ _____
" _____ _____ _____
" _____ _____ _____
" _____ _____ _____

B. Drilling Logs

____Drillers Log
____Sample log
____Drilling time
____Other: _____

VII. -- Cores, samples, & logs, continued

C. Other logs run

___Resistivity
___SP
___Caliper
___Other

___Gamma ray-neutron
___Temperature
___Cement bond

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Oil pipe line pump station - regeneration of zeolite softener.

B. Physical & chemical Description brine solution

C. Volume 160 bpd

IX. Preinjection waste treatment

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results
No gravity flow. Brine pumped into Wellington Lost Circulation Zone.			

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results
None		

C. Injection rates and pressures

1. Rate

Date(s)	Average	Gravity	Maximum
"	"	"	"
"	"	"	"
"	"	"	"
"	"	"	"

2. Pressure (well head _____ bottom hole _____)

Date(s)	Average	Maximum
"	"	"
"	"	"
"	"	"
"	"	"

X. Well operation & operating history

D. Description of operating programs: _____

E. Operating problems: _____

XI. Regulatory aspects.

A. Construction requirements: Conservation Division of Kansas State Corporation Commission, established requirements.

B. Monitoring requirements: _____

C. Restrictions on operating procedure: State Department of Health ordered operations to cease in 1961 because of possible pollution of fresh water.

XII. Economics

A. Total and unit costs of construction _____

B. Operating costs _____

XIII. Source(s) of Information and Pertinent References _____

Written communication - Kansas State Department of Health

Phelps Oil Company

WELL FILE NUMBER

STATE

Xa-16
WELL

I. Operating Company & General Well Location

Security Underground Storage, Inc.

II. Well location (legal description)

Location: SW 1/4, SW 1/4, Sec. 28, T19, R4W, McPherson County, Kansas

III. History, system planning, construction & operation.

Installed in 1958 - purely used

IV. Geology & Geohydrology

A. Regional geologic setting: McPherson County is in the southern portion of the Salina basin. Strata range in age from Ordovician to Permian.

B. Geologic description of rock units penetrated by well
Rock Unit (Geologic Column included -yes___; no X).
(Ground elevation_____) (Total well depth_____)
Datum for depth measurement:_____

Name	Age	Depth (top)	Thickness	Lithologic Description

C. Geologic description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thickness	Character and Areal Distribution
Wellington Formation	Permian	1.5'		

D. Engineering description of injection units

1. Porosity:
2. Permeability:
3. Original Reservoir Pressure:
4. Reservoir Temperature:
5. Chemical Character of Formation Water:
6. Reservoir Fracture Pressure:

IV. Geology & Geohydrology, continued

E. Geohydrology, fresh water aquifers in vicinity

Name	Depth	Thick-ness	Character	Chemical Quality

F. Mineral Resources (oil and gas, coal, brines, etc.)

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface					
Intermed.					
Injection					
Other					

Describe bottom hole completion method.

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: _____

VI. Description of surface equipment

A. Holding tanks & flow lines _____

B. Filters _____

C. Pumps _____

D. Other _____

VII. Cores, samples, & logs

A. Coring

From _____ to _____ Recovery _____

B. Drilling Logs

___Drillers log ___Drilling time

___Sample log ___Other: _____

VII. -- Cores, samples, & logs, continued

C. Other logs run

___Resistivity	___Gamma ray-neutron
___SP	___Temperature
___Caliper	___Cement bond

___Other_____

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Solutioning of salt zone for LP gas storage

B. Physical & chemical Description Brine solution

C. Volume 0-50,000 bpd (2 wells)

IX. Preinjection waste treatment

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results

B. Treatments or stimulation

Zones Treated	Treatment Method	Description of Treatment and Results

C. Injection rates and pressures

1. Rate

Date(s) _____ Average _____ Maximum _____

" _____ " _____ " _____

" _____ " _____ " _____

" _____ " _____ " _____

" _____ " _____ " _____

2. Pressure (well head _____ bottom hole _____)

Date(s) _____ Average Gravity _____ Maximum _____

" _____ " _____ " _____

" _____ " _____ " _____

" _____ " _____ " _____

" _____ " _____ " _____

" _____ " _____ " _____

X. Well operation & operating history

D. Description of operating programs: _____

E. Operating problems: None

XI. Regulatory aspects.

A. Construction requirements _____

B. Monitoring requirements _____

C. Restrictions on operating procedure _____

XII. Economics

A. Total and unit costs of construction

B. Operating costs

XIII. Source(s) of Information and Published References

Written communications - Kansas State Department of Health

Security Underground Storage, Inc. was also contacted, but

did not respond.

WELL FILE NUMBER [illegible] Ks-17 [illegible]

I. Operating Company & General Well Location
Security Underground Storage, Inc.
2nd of 2 wells

II. Well location (legal description)
Location: SW 1/4, Sec. 36, T13, R4W, McPherson County, Kansas

III. History, system planning, construction & operation.
Installed in 1963 - marvin used

IV. Geology : Hydrology
A. Regional geologic setting: See Ks-16

IV. Geology & Geohydrology, continued 2.

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included--yes____; no X).

(Ground elevation_____) (Total well depth_____)

Datum for depth measurement_____

Name	Age	Depth (top)	Thick-ness	Lithologic Description

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thick-ness	Character and Areal Distribution
Arbuckle Ls	Ordovician	3,974'		Limestone, regionally distributed

D. Engineering description of injection units

1. Porosity:_____
2. Permeability:_____
3. Original Reservoir Pressure:_____
4. Reservoir Temperature:_____
5. Chemical Character of Formation Water:_____
6. Reservoir Fracture Pressure:_____

IV. Geology & Geohydrology, continued

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality

F. Mineral Resources (oil and gas, coal, brines, etc.)

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface					
Intermed.					
Injection					
Other					

Describe bottom hole completion method:

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc:_____

VI. Description of surface equipment

A. Holding tanks & flow lines _____

B. Filters _____

C. Pumps _____

D. Other _____

VII. Cores, samples, & Logs

A. Coring

From_____to_____Recovery_____

"

"

"

"

"

B. Drilling Logs

____Drillers Log

____Sample log

____Drilling time

____Other:_____

VII. -- Cores, samples, & logs, continued

C. Other logs run

___Resistivity ___Gamma ray-neutron

___SP ___Temperature

___Caliper ___Cement bond

___Other _____

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Solutioning of salt zone for LP gas storage.

B. Physical & chemical Description Brine solution

C. Volume 0 - 50,000 bbl (2 wells)

IX. Preinjection waste treatment _____

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results

C. Injection rates and pressures

1. Rate

Date(s)	Average	Maximum

2. Pressure (well head _____ bottom hole _____)

Date(s)	Average	Gravity	Maximum

X. Well operation & operation history

D. Description of operating programs: _____

E. Operating problems: None

XI. Regulatory aspects.

A. Construction requirements: _____

B. Monitoring requirements: _____

C. Restrictions on operating procedure _____

XII. Economics

A. Total and unit costs of construction

B. Operating costs

XIII. Source(s) of information and Bibliography

Kansas State Department of Health

Security Underground Storage was also contacted but did not respond.

WELL FILE NUMBER

Xa-18
CWR

I. Operating Company & General Well Location
Mid-American Pipeline Company

II. Well location (legal description)
Location: SW 1/4, Sec. 28, T19, R2W, McPherson County, Kansas

III. History, system planning, construction & operation.
Installed in 1962 - newly used

IV. Geology & Geohydrology

A. Regional geologic setting: McPherson County is in the southern portion of the Salina basin. Strata range in age from Ordovician to Permian.

B. Geologic description of rock units penetrated by well
Rock Unit (Geologic Column included yes___; no X).
(Ground elevation_____) (Total well depth_____)
Datum for depth measurement_____

Name	Age	Depth (top)	Thickness	Lithologic Description

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thickness	Character and Areal Distribution
Arbuckle Lm	Ordovician	3900'		Limestone, regionally distributed

D. Engineering description of injection units

1. Porosity:_____
2. Permeability:_____
3. Original Reservoir Pressure:_____
4. Reservoir Temperature:_____
5. Chemical Character of Formation Water:_____
6. Reservoir Fracture Pressure:_____

IV. Geology & Geohydrology, continued

E. Geohydrology: fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality

F. Mineral Resources (oil and gas, coal, brines, etc.)

V. Well design And construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing Weight & grade	Type	Depth Set	Type & Amount of Cement
Surface					
Intermed.					
Injection					
Other					

Describe bottom hole completion method:

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: _____

VI. Description of surface equipment

A. Holding tanks & flow lines _____

B. Filters _____

C. Pumps _____

D. Other _____

VII. Cores, samples, & logs

A. Coring

From _____ to _____ Recovery _____

B. Drilling Logs

___Drillers Log ___Drilling time

___Sample log ___Other: _____

VII. -- Cores, samples, & logs, continued

C. Other logs run

___Resistivity ___Gamma ray-neutron

___SP ___Temperature

___Caliper ___Cement bond

___Other ___

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Solutioning of salt cavity for storage of LP gas

B. Physical & chemical Description Brine solution

C. Volume 0 - 21,000 bbl

IX. Preinjection waste treatment

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results

C. Injection rates and pressures

1. Rate

Date(s)	Average	Maximum

2. Pressure (well head _____ bottom hole _____)

Date(s)	Average Gravity	Maximum

X. Well operation & operating history

D. Description of operating programs: _____

XI. Operating problems: _____

XI. Regulatory aspects.

A. Construction requirements _____

B. Monitoring requirements _____

C. Restrictions on operating procedure _____

XII. Economics

A. Total and unit costs of construction

B. Operating costs

XIII. Source(s) of Information and Published References

Written Communication - Kansas State Department of Health

Mid-America Pipeline Company was contacted, but did not respond.

WELL FILE NUMBER ~~STRAT~~ Ka-19 ~~UNK~~

I. Operating Company & General Well Location

Atlantic Richfield Company (formerly Sinclair Oil and Gas Company)

II. Well location (legal description)

Location: W 1/2, NW 1/4, NE 1/4, Sec. 14, T24, R6W, Reno County, Kansas

III. History, system planning, construction & operation.

Installed in 1960 to dispose of brine produced while washing out five storage wells for propane and brine that is displaced when propane is pumped into storage. Well is still used.

IV. Geology & Geohydrology

A. Regional geologic setting: Reno County lies between the Anadarko basin on the southwest and the Salina basin on the northeast, on the west side of the Sedgewick basin. Consolidated rocks range in age from Ordovician to Permian or Pennsylvanian. Unconsolidated Cenozoic deposits occur at the surface, at the well location.

IV. Geology & Geohydrology, continued 3.

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included -yes ___; no X).

(Ground elevation _____) (Total well depth 4330)

Datum for depth measurements _____

Name	Age	Depth (top)	Thickness	Lithologic Description
No description of shallow formations available				
Tops given below are from a nearby well.				
Topeka	Pennsylvanian	2354		limestone
Heeppner	Pennsylvanian	2752		sandstone
Lansing	Pennsylvanian	2838		limestone
	Mississippian	3601		limestone
Kinderhookian	Mississippian	3703		shale
Misener	Mississippian	3764		sandstone

C. Geologic Description of injection units & possible units not in use

Rock Unit Name	Age	Depth (top)	Thickness	Character and Areal Distribution
Arbuckle	Ordovician	4130		dolomite & limestone, regionally distributed

D. Engineering Description of injection units

1. Porosity: unknown
2. Permeability: Unknown
3. Original Reservoir Pressure: Unknown
4. Reservoir Temperature: Unknown
5. Chemical Character of Formation Water: No test
6. Reservoir Fracture Pressure: Unknown

435

(Continuation of rock unit descriptions)

Maquoketa	Ordovician	3994	shale
Viola	Ordovician	4020	limestone
Simpson	Ordovician	4046	sandstone
Arbuckle	Ordovician	4140	dolomite and limestone

IV. Geology & Geohydrology, continued 3.

E. Geohydrology, fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality
	26'-51'		Gravel	
	78'-91'		Gravel	

F. Mineral Resources (oil and gas, coal, brines, etc.)

4360'-Pay' - Salt and shale

V. Well Design and Construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing Wt. Lb. & Grade		Size	Depth Set	True & Amount of Cement
Surface	17"	32.75	H-40	13 3/8"	162'	150 Sacks
Intermed.	9"	20.0	N-80	7 "	4130'	1300 Sacks
Tubing				4 1/2"	4110'	Set on N-1 Packer
Injection						
Other						

Describe bottom hole completion method: 4130'-4330' Acid Treatment

5000 Gallons 0-30 Lic. Prem.

V. Well design and construction, continued

B. Packers, Controllers, well head equipment, etc: 4 1/2" tubing set on R-3 Packer

Controllers used on 9" casing

Proper wellhead equipment installed

VI. Description of surface equipment

A. Holding tanks & flow lines 4" flow line from propane storage wells. No tanks for brine storage.

B. Filters None

C. Pumps None

D. Other

VII. Cores, samples, & Logs

A. Coring

From	to	Recovery

B. Drilling Logs

X Drillers Log

___ Sample log

___ Drilling time

___ Other:

VII. -- Cores, samples, & logs, continued

C. Other logs run.

___Resistivity ___Gamma ray-neutron

___SP _X_Temperature

___Caliper ___Cement bond

___Other _____

VIII. Waste Characterization

A. Industrial Process from which waste is derived

Solutioning of salt dome for LP gas storage

B. Physical & chemical Description Brine solution

No data

C. Volume 3 - 5 acre ft

IX. Precipitation with treatment None

B. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results

B. Treatments or Stimulations

Zones Treated	Treatment (type)	Description of Treatment and Results
Arbuckle Lime	1000 Gallons Acid pumped into formation 4130'-4136'	

C. Injection rates and pressures

1. Rate

Date(s) July 2, 1969 Average 1000 bbls/Hr Maximum 2500 bbls/Hr.

2. Pressure (well head ___ bottom hole ___)

Date(s) July 2, 1969 Average Casing Pressure ___ Maximum ___

X. Well operation & operating history

D. Description of operating programs: Have disposed of brine from produced storage wells each year starting July, 1960. Approximately 450,000 - 550,000 barrels injected each year.

E. Operating problems: None

XI. Regulatory aspects

A. Construction requirements: Cemented surface pipe and casing from bottom to top to protection for fresh water zone.

B. Monitoring requirements: Test holes for checking fresh water zone drilled near disposal well. Run chloride test on samples from both water wells. No problems to date.

C. Restrictions on operating procedure

XII. Economics

A. Total and unit costs of construction

B. Operating costs

XIII. Source(s) of Information and Published References

Writing communications - Kansas State Department of Health and Atlantic Richfield Company

WELL FILE NUMBER

Kansas
Ellsworth

Ka-22
Well

I. Operating Company & General Well Location

Northern Gas Products Company (Northern Natural Gas Co.)
Well 1

II. Well location (legal description)

Location: E 1/2, Section 31, T17, R9W, Ellsworth County, Kansas

III. History, system planning, construction & operation.

These wells are rarely used in the normal storage operation. The first well was installed in 1960, and is still in operation.

IV. Geology & Geohydrology

A. Regional geologic setting: Ellsworth County is in the southwest portion of the Salina basin. Strata range in age from Cretaceous to Cretaceous.

IV. Geology & Geohydrology, continued 2.

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included--yes ___; no X).

(Ground elevation 1170) (Total well depth 1350)

Datum for depth measurement "Welex" Radioactivity log

Name	Age	Depth (top)	Thickness	Lithologic Description

C. Geologic description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thickness	Character and Areal Distribution
Arbuckle Is	Ordovician	1320'		limestone, regionally distributed

D. Engineering description of injection units

1. Porosity:
2. Permeability:
3. Original Reservoir Pressure:
4. Reservoir Temperature:
5. Chemical Character of Formation Water:
6. Reservoir Fracture Pressure:

IV. Geology & Geohydrology, continued

E. Geohydrology, fresh water aquifers in vicinity

Name	Depth	Thick. Feet	Character	Chemical Quality

F. Mineral Resources (oil and gas, coal, brines, etc.)

Oil and gas occur in the area

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing; Weight & Grade	Size	Depth Set	Type & Amount of Cement
Surface	12-1/4"		8-5/8"	280'	Unknown
Intermed.					
Injection	7-7/8"	Uncased hole	5-1/2"	4141'	Pozmix 1450 Sacks
Other					

Describe bottom hole completion method: Drilled out - open hole.

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: 6 centralizers, Model 6-1 Halliburton well-head equipment (flanges, and valves)

VI. Description of surface equipment

A. Holding tanks & flow lines (1) 250 bbl. Acmebilt steel tank with oil with (1) approximately 12 bbl. steel holding tank. Flow pipe covered. Lowest line to steel tank with flow control valve.

B. Filters None

C. Pumps None

D. Other

VII. Cores, samples, & Logs

A. Coring

From	to	Recovery
"		
"		
"		
"		
"		
"		

B. Drilling Logs

___Drillers Log ___Drilling time

___Sample log ___Other:

VII. -- Cores, samples, & logs, continued

C. Other logs run

___Resistivity
___SP
___Caliper
___Other

_1_Gamma ray-neutron
___Temperature
___Cement bond

VIII. Waste Characteristics

A. Industrial Process from which waste is derived
LP gas storage operation

B. Physical & chemical Description Saturated sodium brine resulting from solutioning of salt zone to develope storage "jugs".

C. Volume 0 - 96,000 bbl/day (in four wells)

IX. Preinjection waste treatment None

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results

C. Injection rates and pressures

1. Rate

Date(s)	Average	Gravity	Maximum
"	"	"	"
"	"	"	"
"	"	"	"
"	"	"	"

2. Pressure (well head _____ bottom hole _____)

Date(s)	Average	Gravity	Maximum
"	"	"	"
"	"	"	"
"	"	"	"
"	"	"	"

X. Well operation & operating history

D. Description of operating programs: The pressure "Vacuum" checked three times daily by Operating Personnel

E. Operating problems: None

XI. Regulatory aspects.

A. Construction requirements:

B. Monitoring requirements

C. Restrictions on operating procedure

XII. Economics

A. Total and unit costs of construction

B. Operating costs

XIII. Source(s) of Information and Published References

Written information - Kansas State Department of Health and Northern Natural Gas Company

WELL FILE NUMBER ~~Kansas~~ Ks-21

I. Operating Company & General Well Location

Northern Gas Products Company (Northern Natural Gas Co.)
Well 2

II. Well location (legal description)

Location: E 1/2, Section 31, T17, R9W, Ellsworth County, Kansas

III. History; system planning, construction & operation.

Well 2 of a four well disposal operation. Installed in 1960, and is still in operation.

IV. Geology & Geohydrology

A. Regional geologic setting: Ellsworth County is in the southwest portion of the Salina basin. Strata range in age from Ordovician to Cretaceous.

IV. Geology & Geohydrology, continued

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included--yes____; no X).

(Ground elevation_____) (Total well depth 3400)

Datum for depth measurement "Gas Wells" Gamma Ray Neutron Log

Name	Age	Depth (top)	Thickness	Lithologic Description

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thickness	Character and Areal Distribution
Arbuckle Ls	Ordovician	3300'		limestone, regionally distributed

D. Engineering description of injection units

1. Porosity:_____
2. Permeability:_____
3. Original Reservoir Pressure:_____
4. Reservoir Temperature:_____
5. Chemical Character of Formation Water:_____
6. Reservoir Fracture Pressure:_____

IV. Geology & Geohydrology, continued

E. Geohydrology: fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality

F. Mineral Resources (oil and gas, coal, brines, etc.)

Oil and gas occur in the area.

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing: Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface	12-1/4"	Unknown (in hole)	8-5/8"	201'	Unknown
Intermed.					
Injection	7-7/8"	14# H 40	5-1/2"	3366'	Pozmix 2100 Sacks
Other					

Describe bottom hole completion method: Drilled out - open hole.

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: 6 centralizers, Model S-9 - Halliburton well head equipment (flanged and valved)

VI. Description of surface equipment

A. Holding tanks & flow lines (1) 210 bbl. Asphalt lined catch pit with (1) approximately 15,000 steel holding tank, fiber glass covered Located inside lined pit with flow control valve.

B. Filters None

C. Pumps None

D. Other

VII. Cores, samples, & Logs

A. Coring

From _____ to _____ Recovery _____

" _____ _____ _____

" _____ _____ _____

" _____ _____ _____

" _____ _____ _____

" _____ _____ _____

B. Drilling Logs

____Drillers Log

____Sample log

____Drilling time

____Other: _____

VII. -- Cores, samples, & logs, continued

C. Other logs run

___Resistivity
___SP
___Caliper
___Other

X Gamma ray-neutron
___Temperature
___Cement bond

VIII. Waste Characteristics

A. Industrial Process from which waste is derived Same as 1

B. Physical & chemical Description Same as 1

C. Volume Same as 1

IX. Preinjection waste treatment None

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results

C. Injection rates and pressures

1. Rate

Date(s)_____ Average _____ Gravity _____ Maximum _____

" _____ " _____ " _____

" _____ " _____ " _____

" _____ " _____ " _____

" _____ " _____ " _____

2. Pressure (well head _____ bottom hole _____)

Date(s)_____ Average _____ Gravity _____ Maximum _____

" _____ " _____ " _____

" _____ " _____ " _____

" _____ " _____ " _____

" _____ " _____ " _____

X. Well operation & operating history

B. Description of operating programs: [illegible]

E. Operating problems: None

XI. Regulatory aspects.

A. Construction requirements

B. Monitoring requirements

C. Restrictions on operating procedure

XII. Economics

A. Total and unit costs of construction

B. Operating costs

XIII. Source(s) of Information and Published References

Written communications - Kansas State Department of Health and Northern Natural Gas Company

WELL FILE NUMBER

~~[illegible]~~ Ks-22
~~D.M.S.~~ DMR

I. Operating Company & General Well Location
Northern Gas Products Company (Northern Natural Gas Co.)
Well 3

II. Well location (legal description)
Location: E 1/2, Section 31, T17, R9W, Ellsworth County, Kansas

III. History, system planning, construction & operation.
Well completed in 1967, and is still in operation.

IV. Geology & Geohydrology
A. Regional geologic setting: Ellsworth County is in the southwest portion of the Saline basin. Strata range in age from Ordovician to Cretaceous.

IV. Geology & Geohydrology, continued

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included--yes____; no X).

(Ground elevation_____) (Total well depth 3670')

Datum for depth measurement "Chet Brown Co" Gamma-Ray Neutron Log

Name	Age	Depth (top)	Thick-ness	Lithologic Description

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thick-ness	Character and Areal Distribution
Arbuckle Ls	Ordovician	3300'		limestone, regionally distributed

D. Engineering description of injection units

1. Porosity:
2. Permeability:
3. Original Reservoir Pressure:
4. Reservoir Temperature:
5. Chemical Character of Formation Water:
6. Reservoir Fracture Pressure:

IV. Geology & Geohydrology, continued

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality

F. Mineral Resources (oil and gas, coal, brines, etc.)

Oil and gas occur in the area.

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing: Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface	12-1/4"	[illegible] H-40	9-5/8"	324'	300 Sacks Pozmix
Intermed.	8-3/8"	[illegible] H-40	7-1/8"	[illegible]	1150 Sacks Pozmix
Injection	[illegible]	[illegible] H-40	5-1/2"	3280'	
Other					

Describe bottom hole completion method: Drilled out - open hole

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: 11 - Centralizers - Model S-3 Halliburton

Well Head Equipment (Flanged and Valved)

VI. Description of surface equipment

A. Holding tanks & flow lines (1) 250 Bbl. Asphalt Lined Catch Pit with (1) Approx. 1½ bbl. steel holding tank. Fiber Glass covered. Located inside lined pit with flow. Control valve.

B. Filters None

C. Pumps None

D. Other

VII. Cores, samples, & Logs

A. Coring

From _____ to _____ Recovery _____

" _____ _____ _____

" _____ _____ _____

" _____ _____ _____

" _____ _____ _____

" _____ _____ _____

B. Drilling Logs

____Drillers Log

____Sample log

____Drilling time

____Other: _____

VII. -- Cores, samples, & logs, continued

C. Other logs run

___Resistivity
___SP
___Caliper
___Other

_X_Gamma ray-neutron
___Temperature
___Cement bond

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Same as 1

B. Physical & chemical Description Same as 1

C. Volume Same as 1

IX. Preinjection waste treatment None

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results

C. Injection rates and pressures

1. Rate

Date(s)	Average	Gravity	Maximum
"	"	"	"
"	"	"	"
"	"	"	"
"	"	"	"

2. Pressure (well head _____ bottom hole _____)

Date(s)	Average	Gravity	Maximum
"	"	"	"
"	"	"	"
"	"	"	"
"	"	"	"

X. Well operation & operating history

D. Description of operating programs: The Pressure "Vacuum" checked three times daily by Operating Personnel.

E. Operating problems: None

XI. Regulatory aspects.

A. Construction requirements

B. Monitoring requirements

C. Restrictions on operating procedure

XII. Economics

A. Total and unit costs of construction

B. Operating costs

XIII. Source(s) of Information and Published References

Written communications - Kansas State Department of Health and Northern Natural Gas COmpany

WELL FILE NUMBER KANSAS STATE Ka-23 UMR

I. Operating Company & General Well Location

Northern Gas Products Company (Northern Natural Gas Co.)
Well 4

II. Well location (legal description)

Location: E 1/2, Section 31, T17, R9W, Ellsworth County, Kansas.

III. History; system planning, construction & operation.

Well 4 completed in 1969, and is still in operation.

IV. Geology & Geohydrology

A. Regional geologic setting: Ellsworth County is in the southwest portion of the Salina basin. Strata range in age from Ordovician to Cretaceous.

IV. Geology & Geohydrology, continued

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included--yes____; no x).

(Ground elevation_____) (Total well depth 3745')

Datum for depth measurement "Chet Brown Co" Gamma-Ray Neutron Log

Name	Age	Depth (top)	Thick-ness	Lithologic Description

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thick-ness	Character and Areal Distribution
Arbuckle Ls	Ordovician	3300'		limestone, regionally distributed

D. Engineering description of injection units

1. Porosity:
2. Permeability:
3. Original Reservoir Pressure:
4. Reservoir Temperature:
5. Chemical Character of Formation Water:
6. Reservoir Fracture Pressure:

IV. Geology & Geohydrology, continued

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thick-ness	Character	Chemical Quality

F. Mineral Resources (oil and gas, coal, brines, etc.)

Oil and gas occur in the area.

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing: Weight & grade		Size	Depth Set	Type & Amount of Cement
Surface	12-1/4"	32.75#	H-40	10-3/4"	315	Pozmix 275 sacks
Intermed.	9"	20#	H-40	7-5/8"	3315	Pozmix 1100 sacks
Injection		14#	H-40	5-1/2"	3283	
Other						

Describe bottom hole completion method: Drilled out - open hole

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc:

11 - Centralizers - Model S-3 Halliburton

Well head equipment (Flanced and Valved)

VI. Description of surface equipment

A. Holding tanks & flow lines (1) 250 Bbl asphalt lined catch pit with (1) Approximately 15 bbl. steel holding tank. Fiber Glass covered Located inside lined pit with Flow Control Valve.

B. Filters None

C. Pumps None

D. Other

VII. Cores, samples, & Logs

A. Coring

From _____ to _____ Recovery _____

" _____ _____ _____

" _____ _____ _____

" _____ _____ _____

" _____ _____ _____

" _____ _____ _____

B. Drilling Logs

___Drillers Log

___Sample log

___Drilling time

___Other: _____

VII. -- Cores, samples, & logs, continued

C. Other logs run

____Resistivity
____SP
____Caliper
____Other

__x__Gamma ray-neutron
____Temperature
____Cement bond

VIII. Waste Characteristics

A. Industrial Process from which waste is derived
Same as 1

B. Physical & chemical Description Same as 1

C. Volume Same as 1

IX. Preinjection waste treatment None

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results

C. Injection rates and pressures

1. Rate

Date(s)	Average	Gravity	Maximum
"	"	"	"
"	"	"	"
"	"	"	"
"	"	"	"

2. Pressure (well head _____ bottom hole _____)

Date(s)	Average	Gravity	Maximum
"	"	"	"
"	"	"	"
"	"	"	"
"	"	"	"

X. Well operation & operating history

D. Description of operating programs: The pressure "vacuum" checked three times daily by Operating Personnel.

E. Operating problems: None

XI. Regulatory aspects.

A. Construction requirements

B. Monitoring requirements

C. Restrictions on operating procedure

XII. Economics

A. Total and unit costs of construction _____

B. Operating costs _____

XIII. Source(s) of Information and Published References _____

Written communications - Kansas State Department of Health and Northern Natural Gas Company

WELL FILE NUMBER _____ STATE Ka-24 ONWR

I. Operating Company & General Well Location

Morton Salt Company

II. Well location (legal description)

Location: N 1/2, SE 1/4, Sec. 22, T23, R6W, Reno County, Kansas.

III. History; system planning, construction & operation.

Installed in 1967, apparently still used.

IV. Geology & Geohydrology

A. Regional geologic setting: Reno County lies on the west edge of the Sedgewick basin, and between the Anadarko basin on the south and the Salina basin on the north.

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included--yes____; no X).

(Ground elevation_____) (Total well depth_____)

Datum for depth measurement_____

Name	Age	Depth (top)	Thickness	Lithologic Description

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thickness	Character and Areal Distribution
Arbuckle ls	Ordovician	4200'	500'	dolomite and limestone, regionally distributed

D. Engineering description of injection units

1. Porosity:_____
2. Permeability:_____
3. Original Reservoir Pressure:_____
4. Reservoir Temperature:_____
5. Chemical Character of Formation Water:_____
6. Reservoir Fracture Pressure:_____

IV. Geology & Geohydrology, continued

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality

F. Mineral Resources (oil and gas, coal, brines, etc.)

Salt is mined hydraulically by Morton Salt Company.

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface					
Intermed.					
Injection					
Other					

Describe bottom hole completion method:

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: _____

VI. Description of surface equipment

A. Holding tanks & flow lines _____

B. Filters _____

C. Pumps _____

D. Other _____

VII. Cores, samples, & Logs

A. Coring

From _____ to _____ Recovery _____

" _____ _____ _____

" _____ _____ _____

" _____ _____ _____

" _____ _____ _____

" _____ _____ _____

B. Drilling Logs

____Drillers Log

____Sample log

____Drilling time

____Other: _____

VII. -- Cores, samples, & logs, continued

C. Other logs run

____Resistivity
____SP
____Caliper
____Other

____Gamma ray-neutron
____Temperature
____Cement bond

VIII. Waste Characteristics

A. Industrial Process from which waste is derived
Hydraulic salt mining

B. Physical & chemical Description Sodium brine solution

C. Volume 1,000 - 2,500 bpd

IX. Preinjection waste treatment

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results

C. Injection rates and pressures

1. Rate

Date(s)	Average	Maximum
"	"	"
"	"	"
"	"	"

2. Pressure (well head ____ X ____ bottom hole ____)

Date(s)	Average Gravity	Maximum
"	"	"
"	"	"
"	"	"
"	"	"

X. Well operation & operating history

D. Description of operating programs:

E. Operating problems: None

XI. Regulatory aspects.

A. Construction requirements

B. Monitoring requirements

C. Restrictions on operating procedure

XII. Economics

A. Total and unit costs of construction

B. Operating costs

XIII. Source(s) of Information and Published References

Written communications - Kansas State Department of Health
Morton Salt Company was contacted, but company policy prevented release of information.

WELL FILE NUMBER

Ea-25

I. Operating Company & General Well Location

Farmland Industries, Inc.
Dodge City, Kansas

II. Well location (legal description)

Location: Center of north half, SW 1/4, NE 1/4, Sec. 22, T26S, R24E, Ford County, Kansas

III. History, system planning, construction & operation.

Farmland through their associate company, Terra Resources, and with the Technical assistance of J. W. Rockhold (consultant), and Garvey Drilling Company designed, planned, and constructed the #1 Fee well for Ammonia Plant effluent subsurface disposal. Evaluation of the pore for commercial oil was also conducted. A show of oil in the conglomerate sand at 4996 to 5001 feet was tested at the rate of 8 BOD and cemented off with 100 sacks. The well was completed April 5, 1968. Its use is standby to accept emergency spills or all plant effluent to maintain production. Plant effluent is 750,000 gallons per day. The well capacity exceeds 500,000 gpd at less than zero well head pressure.

IV. Geology & Geohydrology

A. Regional geologic setting: Ford County is on the north edge of the Anadarko basin.

IV. Geology & Geohydrology, continued 2.

B. Geologic description of rock units penetrated by well
Rock Unit (Geologic Column included yes ___; no X).
(Ground elevation [illegible] ft.) (Total well depth 6507ft.)
Datum for depth measurement K. B. 2161

Name	Age	Depth (top)	Thick-ness	Lithologic Description
Topeka	Pennsylvanian	3732	424	limestone and shale
Lansing	Pennsylvanian	4329	362	limestone and shale
Marmaton	Pennsylvanian	4720	163	limestone and shale
- - -	Pennsylvanian	4987	75	porous ss. with oil shows
Warsaw	Mississippian	5232	54	chert, dolomite, & limestone
Osage	Mississippian	5302	234	chert, dolomite, & limestone
Kinderhook	Mississippian	5540	139	limestone, chert, and shale
Viola	Ordovician	5679	87	dolomite, chert, and shale

C. Geologic Description of injection units & possible units not in use

Rock Unit Name	Age	Depth (top)	Thick-ness	Character and Areal Distribution
Arbuckle	Ordovician	[illegible]	[illegible]'-6507	dolomite, regionally distributed

D. Engineering description of injection units

1. Porosity: 15% vugular and fractured
2. Permeability: very high
3. Original Reservoir Pressure: about 2000 psi
4. Reservoir Temperature. 130°F
5. Chemical Character of Formation Water: No analysis was made, however other analyses show the water to be saline and to contain H_2S
6. Reservoir Fracture Pressure:

(continuation of IV - B)

Simpson	Ordovician	5679	87	dolomite, chert, and shale
Arbuckle	Ordovician	5820	687	dolomite, with porous zones

IV. Geology & Geohydrology, continued 3.

E. Geohydrology, fresh water aquifers to vicinity

Name	Depth base	Thickness	Character	Chemical Quality
- - -	Surface to 1500'+/-		sandstones	fresh water

F. Mineral Resources (oil and gas, coal, brines, etc.)

Oil and gas occur in economic quantities below 2,600 feet, where structure is favorable.

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing. Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface	12 1/4in.	24# J-55	8 5/8in.	1654	550 sacks
Intermed.					
Injection	7 7/8	15# J-55	5 1/2in.	5835	125 sacks
Other					

Describe bottom hole completion method: open hole completion

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: Centralizers on 8 5/8 casing at 1664 and 1631ft., and on 5 1/2 at 1320, 5737, 5633, and 5637

VI. Description of surface equipment

A. Holding tanks & flow lines yes, in plant

B. Filters yes, in plant

C. Pumps well should accept about one million gallons per day without an injection pump

D. Other:

VII. Cores, samples, & Logs

A. Coring

	From	to	Recovery
"			
"			
"			
"			
"			

B. Drilling Logs

____Drillers Log

__X__Sample log

__X__Drilling time

____Other:

VII. -- Cores, samples, & logs, continued

C. Other logs run

X Resistivity	___Gamma ray-neutron
___SP	___Temperature
X Caliper	___Cement bond
___Other Casing collar	

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Ammonia plant

B. Physical & chemical Description water plus 1000ppm ammonium bicarbonate

Usually diluted with fresh water to 55ppm NH_4HCO_3 prior to discharge to retention ponds and irrigation use.

C. Volume 432,000 gallons per day maximum, 160,000 gpd average.

IX. Preinjection waste treatment Waste water is discharge to retention ponds; normally it will be used for crop irrigation; except when stripper tower is inoperative, then the waste will go down the well.

4. Well operation & operating history 4.

A. Tests

Type	Purpose	Zones tested	Description of test results
1. Open hole - Drill Stem Test	1.25 bpd.	[illegible]	Recovered gas to surface in minutes & [illegible] of muddy gassy oil.
2. Open Hole Drill Stem Test		5252' to 5320'	Rec. 63' slightly oil cut water with [illegible] water "mud"
3. Open hole - DST	1.5 bpd.	[illegible]	Rec. [illegible] water & oil
4. Casing Test	Natural	[illegible]	[illegible]
	250 gal.acid	[illegible]	[illegible]
	500 gal.mud acid	[illegible]	[illegible]
5. Upper Arbuckle		[illegible]	Water, 300 barrels

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results
None		

C. Injection rates and pressures

1. Rate

Date(s) _____ Average 0 to 15000+ max. Maximum _____

" _____ " <4200bpd " _____

" _____ " _____ " _____

" _____ " _____ " _____

2. Pressure (Well head X bottom hole)

Date(s) _____ Average Gravity Maximum _____

" _____ " _____ " _____

" _____ " _____ " _____

" _____ " _____ " _____

" _____ " _____ " _____

(continuation of X - A)

6. Upper & Lower Arbuckle

15,540 gallons per hour or
373,000 gallons per day on vacuum.
"3" line restricted available field."
5835' to 6507'
18,060 gallons per hour or
433,440 gallons per day on "Vacuum"
10,320 Barrels per day without acid stimulation and short term test.

187

7. No capacity vs pressure tests taken

5. Well operation & operating history

B. Description of sampling program: [illegible]

B. Sampling problems: [illegible]

11. [illegible]

A. [illegible]

B. Reporting requirements [illegible]

C. Restrictions on operating procedures [illegible]

XII. Economics

A. Total and unit costs of construction $75,000.00

B. Operating costs None available

XIII. Source(s) of information and Published References

Kansas State Health Department

Terra Resources, Inc. associate company of Farmland Industries, Inc.

WELL FILE NUMBER ~~STATE~~ Ks-26 ~~END~~

I. Operating Company & General Well Location

Mid-West Underground Storage, Inc.

II. Well location (legal description)

Location: NW 1/4, Section 29, T19, R4W, McPherson County, Kansas

III. History, system planning, construction & operation.

Installed in 1970, used primarily during the development of storage caverns, rarely used otherwise.

IV. Geology & Geohydrology

A. Regional geologic setting: McPherson County is in the southern portion of the Salina basin. Strata range in age from Ordovician to Permian.

4:30

B. Geologic description of rock units penetrated by well
Rock Unit (Geologic Column included -yes ___; no X).
(Ground elevation_____) (Total well depth_____)
Datum for depth measurement_____

Name	Age	Depth (top)	Thickness	Lithologic Description
Arbuckle	Ordovician	4200'		
Granite Wash				

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thickness	Character and Areal Distribution
Arbuckle	Ordovician	4200'		dolomite and limestone regionally distributed

D. Engineering description of injection units

1. Porosity:_____
2. Permeability:_____
3. Original Reservoir Pressure:_____
4. Reservoir Temperature:_____
5. Chemical Character of Formation Water:_____
6. Reservoir Fracture Pressure:_____

IV. Geology & Geohydrology, continued

E. Geohydrology, fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality

F. Mineral Resources (oil and gas, coal, brines, etc.)

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface					
Intermed.					
Injection					
Other					

Describe bottom hole completion method:

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: _____

VI. Description of surface equipment

A. Holding tanks & flow lines _____

B. Filters _____

C. Pumps _____

D. Other _____

VII. Cores, samples, & logs

A. Coring

From _____ to _____ %recovery _____

" _____ _____ _____

" _____ _____ _____

" _____ _____ _____

" _____ _____ _____

" _____ _____ _____

B. Drilling logs

___Drillers log ___Drilling time

___Sample log ___Other: _____

VII. -- Cores, samples, & logs, continued

C. Other logs run

___Resistivity ___Gamma ray-neutron

___SP ___Temperature

___Caliper ___Cement bond

___Other

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Solutioning of salt zone for gas storage.

B. Physical & chemical Description Brine solution

C. Volume 0 - [illegible],000 bbl

IX. Preinjection waste treatment

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results

C. Injection rates and pressures

1. Rate

Date(s) _____ Average _____ Maximum 48,000 barrel per day

2. Pressure (well head _____ bottom hole _____)

Date(s) _____ Average _____ Gravity _____ Maximum _____

X. Well operation & operating history

D. Description of operating programs: Used primarily during the development os storage caverns, rarely used otherwise.

E. Operating problems: None

XI. Regulatory aspects.

A. Construction requirements

B. Monitoring requirements

C. Restrictions on operating procedure

XII. Economics

A. Total and unit costs of construction

B. Operating costs

XIII. Source(s) of Information and Published References

Written communications - Kansas State Department of Health

Mid-West Underground Storage was contacted, but did not reply.

WELL FILE NUMBER _____ STATE Ka-27 UMR

I. Operating Company & General Well Location

American Salt Company

II. Well location (legal description)

Location: SE 1/4, Sec. 15, T15, R6W, Rice County, Kansas.

III. History, system planning, construction & operation.

Installed in 1968, presently in use. The well is used for disposal of brine from hydraulic salt mining and processing operations.

IV. Geology & Geohydrology

A. Regional geologic setting: Rice County is on the Central Kansas uplift southwest of the Salina basin.

IV. Geology & Geohydrology, continued

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included--yes____; no X).

(Ground elevation_____) (Total well depth_____)

Datum for depth measurement_____

Name	Age	Depth (top)	Thick-ness	Lithologic Description

C. Geologic Description of injection units & possible units not in use

Rock Unit Name	Age	Depth (top)	Thick-ness	Character and Areal Distribution
Arbuckle Ls	Ordovician	3501'	- - -	porous dolomite and limestone, regionally distributed

D. Engineering description of injection units

1. Porosity:_____
2. Permeability:_____
3. Original Reservoir Pressure:_____
4. Reservoir Temperature:_____
5. Chemical Character of Formation Water:_____
6. Reservoir Fracture Pressure:_____

IV. Geology & Geohydrology, continued

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality

F. Mineral Resources (oil and gas, coal, brines, etc.)

Salt is hydraulically mined by American Salt Company

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing. Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface					
Intermed.					
Injection					
Other					

Describe bottom hole completion method:

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: _____

VI. Description of surface equipment

A. Holding tanks & flow lines _____

B. Filters _____

C. Pumps _____

D. Other _____

VII. Cores, samples, & Logs

A. Coring

From _____ to _____ Recovery _____

" _____ _____ _____

" _____ _____ _____

" _____ _____ _____

" _____ _____ _____

" _____ _____ _____

B. Drilling Logs

____Drillers Log

____Sample log

____Drilling time

____Other: _____

VII. [illegible] forms, samples, & logs, continued

C. Other logs run

[illegible]Resistivity
[illegible]SP
[illegible]Velocity
[illegible]Other

[illegible]Cement bond log
[illegible]Temperature
[illegible]Caliper log

VIII. Water Characteristics

A. Depth(s) drilled where water was encountered

[illegible]Cretaceous salt water

B. Physical & chemical characteristics [illegible]

C. Volume [illegible]

IX. Production zone tested [illegible]

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and results

C. Injection rates and pressures

1. Rate

Date(s)	Average	Maximum
"	"	"
"	"	"
"	"	"
"	"	"

2. Pressure (well head ___X___ bottom hole _____)

Date(s)	Average	Gravity	Maximum
"	"	"	"
"	"	"	"
"	"	"	"
"	"	"	"

X. Well operation & operating history

D. Description of operating programs: _____

E. Operating problems: None

XI. Regulatory aspects.

A. Construction requirements _____

B. Monitoring requirements _____

C. Restrictions on operating procedure _____

XII. Economics

A. Total and unit costs of construction

B. Operating costs

XIII. Source(s) of information and published references.

Written communications - Kansas State Department of Health

American Salt Company was contacted but did not reply.

WELL FILE NUMBER

STATE

Ky-1

I. Operating Company & General Well Location

Sohio Petroleum Company

Latonia, Kentucky

II. Well location (legal description)

Location: Kenton County, Kentucky

Carter coordinate 12-EN-60

III. History, system planning, construction & operation.

The well operated from 1948 to 1954 and briefly during 1962. It was been plugged and abandoned. The well was apparently successful, but was not used much after 1954 because a market was developed for the chemicals in the wastewater.

IV. Geology & Geohydrology

A. Regional geologic setting: The well is located on the axis of the Cincinnati arch. Bedrock at the site is shale of Ordovician age.

V. Geology & Groundwater, continued

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included--yes ___; no X).
(Ground elevation _____) (Total well depth 1011)
Datum for depth measurement Derick floor 47[illegible].ft.

Name	Age	Depth (top)	Thickness	Lithologic Description
den	Ordovician	50	79	shale
renton	Ordovician	129	134	limestone
	Ordovician	263	441	shale and limestone
t. Peter		704	82	sandstone
nax	Cambro-Ord.	786	not completely drilled	dolomite

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thickness	Character and Areal Distribution
t. Peter	Ordovician	704	82	sandstone-regionally distributed
nax	Cambro-Ord.	786	225 (total drilled)	dolomite-regionally distributed

D. Engineering description of injection units

1. Porosity:
2. Permeability:
3. Original Reservoir Pressure:
4. Reservoir Temperature:
5. Chemical Character of Formation Water:
6. Reservoir Fracture Pressure:

IV. Geology & Geohydrology, continued 3.

E. Geohydrology, fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality

F. Mineral Resources (oil and gas, coal, brines, etc.)

A small amount of natural gas was encountered in drilling the well, but not in commercial quantities. No other resources occur locally.

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing, Weight & Grade	Size	Depth Set	Type & Amount of Cement
Surface			13in.	78ft.	
Intermed.					
Injection			Tbg.	506ft.	130 sacks
Other					

Describe bottom hole completion method: open hole

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: _____

VI. Description of surface equipment

A. Holding tanks & flow lines _____

B. Filters _____

C. Pumps _____

D. Other _____

VII. Cores, samples, & Logs

A. Coring

From	to	Recovery

B. Drilling Logs

___Drillers Log ___Drilling time

___Sample log ___Other: _____

VII. -- Cores, samples, & logs, continued

C. Other logs run

___Resistivity
___SP
___Caliper
___Other

___Gamma ray-neutron
___Temperature
___Cement bond

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Refinery

B. Physical & chemical Description Caustic wastewater

C. Volume

IX. Preinjection waste treatment

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results

C. Injection rates and pressures

1. Rate

Date(s)	Average	Maximum

2. Pressure (well head _____ bottom hole _____)

Date(s)	Average	Maximum

X. Well operation & operating history

D. Description of operating programs:

E. Operating problems:

XI. Regulatory aspects.

A. Construction requirements

B. Monitoring requirements

C. Restrictions on operating procedure

XII. Economics

A. Total and unit costs of construction _____

B. Operating costs _____

XIII. Source(s) of Information and Published References _____

Kentucky Geological Survey

WELL FILE NUMBER | Kentucky Permit STATE #24576 | Ky-2 UMR

I. **Operating Company & General Well Location**

E. I. duPont de Nemours & Co., Inc,
Louisville, Kentucky

II. **Well location (legal description)**

Location: Jefferson Co. Carter Coord. Sec. 10 Letter U No 44
921.9 FSL & 2763.4' FWL

III. **History, system planning, construction & operation.**

Permit application -
Permit granted - 11/10/70
Well spudded - 2/6/71
Well completed - 3/30/71
Well testing - 3/31/71 to 6/27/71
Injection started - have not begun injection as of 6/27/72

IV. **Geology & Geohydrology**

A. **Regional geologic setting:** Well is located on the flood-plain of the Ohio River. Bedrock is the New Albany Shale (lower Mississippian).

IV. Geology & Geohydrology, continued 2.

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included -yes X ; no ___).

(Ground elevation 452') (Total well depth 6911)

Datum for depth measurement Kelly Bushing 462

Name	Age	Depth (top)	Thickness	Lithologic Description
See attached sheet				

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thickness	Character and Areal Distribution
Knox	Ord-Cam.	3710'	2490'	dolomite-white-tan
Mt. Simon	Cambrian	5086'	594'	sandstone-white-tan

Injection is planned for the Knox - between 3100' and 4500'

D. Engineering description of injection units

1. Porosity:
2. Permeability:
3. Original Reservoir Pressure:
4. Reservoir Temperature: Knox 74°-90°; Mt. Simon 11[illegible]°
5. Chemical Character of Formation Water: From analysis of water obtained from DST 3,350 to 3,560ft., total dissolved solids 21,000mg/l, pH 7.0, Na 6,000mg/l, Ca 1,[illegible]mg/l, Cl 10,000mg/l, SO_4 3,100mg/l
6. Reservoir Fracture Pressure: Mt. Simon was fractured but breakdown pressure was not reported. Maximum pressure at about 5,500 feet was reported as 6,000psi.

10. Geology & Geohydrology, continued

B. Geohydrology: Fresh water aquifers in vicinity

Name	Depth	Water qual.	Character	Chemical Quality

F. Mineral resources (oil & gas, coal, metals, etc.)

None in immediate vicinity.

9 Well design and construction

A. Casing, tubing, and fittings

	Hole Dia.	Casing or Tubing Size & Grade	Depth	Wt.	Type & Amount of Cement
Surface	12 1/4"	8 5/8" J-55 ST&C new casing	1500'	24#	Full circulation
Intermed.	7 7/8"	5 1/2" J-55 LT&C new casing	7500'	15.5#	See attached Well Program for proposed well design.
Injection					
Other					

Describe Buffalo Wash Unit completion method: Open hole

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: _____

VI. Description of surface equipment

A. Holding tanks & flow lines _____

B. Filters _____

C. Pumps _____

D. Other _____

VII. Cores, samples, & Logs

A. Coring

From	2822	to 2835	Recovery 13ft.
"	4409	4459	full
"	5335	5335	1/2in.
"	5335	5338	2ft.
"	5718	5748	full
"	5993	6008	15ft.

B. Drilling Logs

X Drillers Log ___ Drilling time

X Sample log ___ Other: _____

517

A total of 16 cores were taken in interval from 1153 to 6008. Only cores #10 to #16 are listed above.

VII. -- Cores, samples, & logs, continued

C. Other logs run

X Resistivity	X Gamma ray-neutron
X SP	X Temperature
X Caliper	___ Cement bond

___ Other Synergetic, density, GR-tracer, HDT, SHT, Sonic

VIII. Waste Characteristics Borehole comp., dual induct., laterlog, microlaterlog

A. Industrial Process from which waste is derived

B. Physical & chemical Description Aqueous hydrochloric acid solution having a maximum concentration of 20 wt. % S.G. 1.103, temp. 140°F. The waste will not have more than 100ppm "organics."

C. Volume Injection has not yet begun (6/27/72)

IX. Preinjection waste treatment

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results
2 DST's were run in the intervals 4300-4500, 4130-4130, 3850-4050, 3150-3550, 2970-3170, 2690-2890, 1400-1600, 2978-3178, 5808-6009			
Injection profiles Mt. Simon Fm. and Knox Fm.			
Injection tests Mt. Simon unsatisfactory			
Injection		Knox-Conasauga	
	2hr. 15min.	3150-4497	150gpm @ 1350psi
	2hr. 25min.	2650-4497	150gpm @ 175psi

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results
Mt. Simon	fractured and acidized	not successful
Knox	Not Used	

C. Injection rates and pressures - not yet in operation,
see test results for Knox

1. Rate

Date(s)	Average	Maximum

2. Pressure (well head _____ bottom hole _____)

Date(s)	Average	Maximum

X. Well operation & operating history

D. Description of operating program: _____

E. Operating problems: _____

XI. Regulatory aspects.

A. Construction requirements _____

B. Monitoring requirements _____

C. Restrictions on operating procedure _____

XII. Economics

A. Total and unit costs of construction _____

B. Operating costs _____

XIII. Source(s) of information and Published References _____

Kentucky Geological Survey

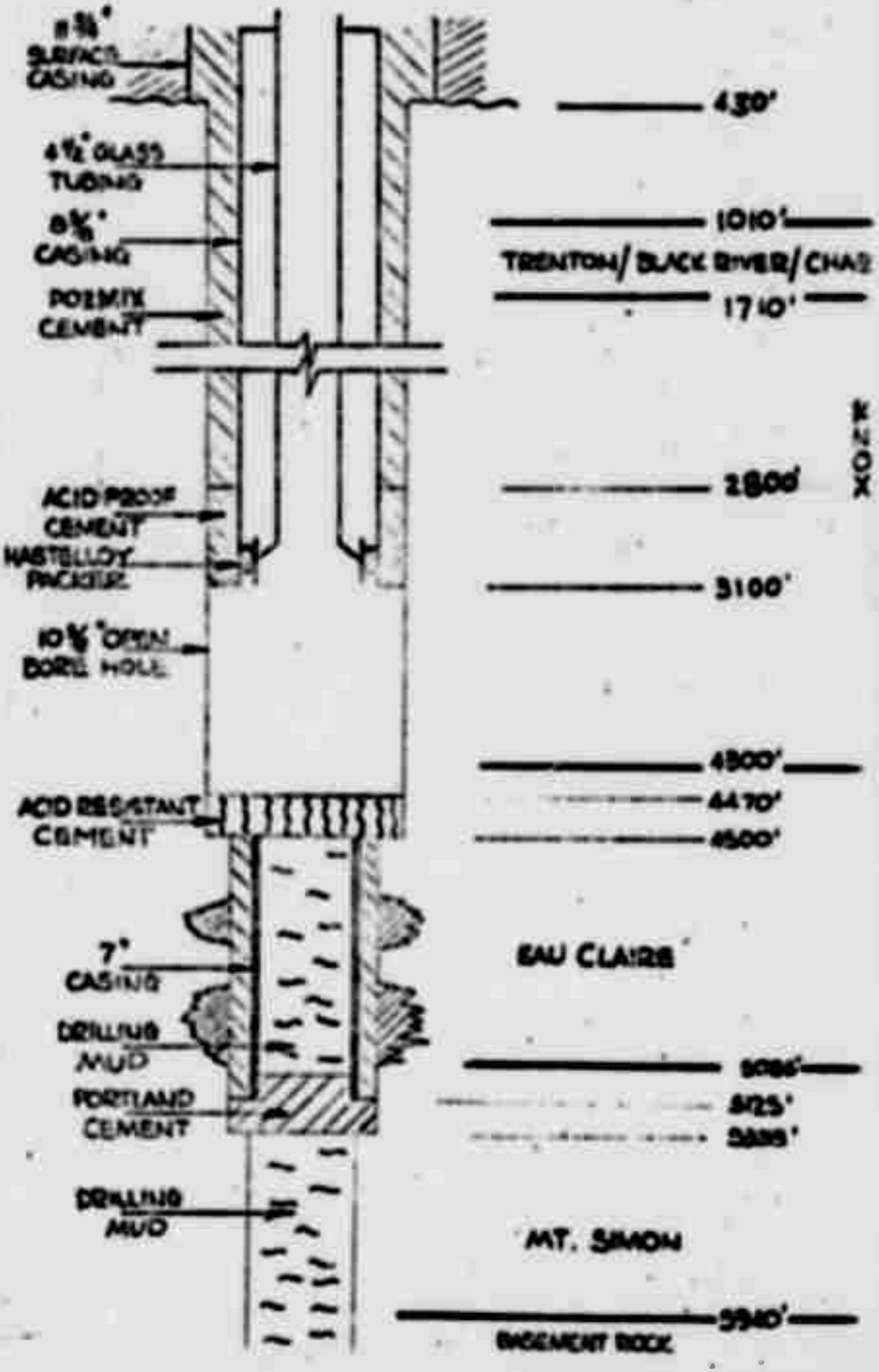
K-1

13. Subsurface Geology

Depth	Top Corrected To Sea Level	Thickness	Formation	Lithology
0' - 125'	+ 464'	125'	Alluvium	Sands and gravels
125' - 215'	+ 339'	90'	Devonian	Shale and limestone
215' - 370'	+ 249'	155'	Silurian	Dolomite and limesto
370' - 1010'	+ 94'	640'	Ordovician	Shale, limestone, dolomite, siltstone
1010' - 1150'	- 546'	140'	Trenton	Limestone
1150' - 1570'	- 686'	420'	Black River	Limestone
1570' - 1700'	- 1106'	130'	Chazyan	Dolomite
1700' - 1710'	- 1236'	10'	St. Peter	Sandstone
1710' - 4300'	- 1246'	2590'	Knox	Dolomite (Fractured and caverous in part)
4300' - 5086'	- 3836'	786'	Eau Claire	Dolomite and shale
5086' - 5940'	- 4622'	854'	Mt. Simon	Sandstone and shale
5940' - 6008'	- 5476'	68'	Pre-Cambrian	Serpentine

W.D.W. No. 1 KNOX COMPLETION

FIGURE 2



WELL FILE NUMBER ~~Kentucky~~ ~~S.W.I.C.~~ Permit: #25288 KY-3 ~~GW~~

I. Operating Company & General Well Location

E. I. duPont deNemours & Co., Inc.
Louisville, Kentucky

II. Well location (legal description)

Location: Jefferson Co., Sec. 11, U 44 - 5307' FWL
2275' FNL

III. History, system planning, construction & operation.

Permit application - 8/20/71
Permit granted - 10/26/71
Well completion report not yet submitted.

IV. Geology & Geohydrology

A. Regional geologic setting: Well is located on the flood-plain of the Ohio River. Bedrock is the New Albany shale (lower Mississippian).

B. Geologic description of rock units penetrated by well
Rock Unit (Geologic Column included -yes___; no X).
(Ground elevation_____) (Total well depth_____)
Datum for depth measurement:_____

Name	Age	Depth (top)	Thickness	Lithologic Description
Not yet available - See Ky-2				

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thickness	Character and Areal Distribution
Knox	Ord.-Camb.	- - -	- - -	dolomite
Mt. Simon	Camb.	- - -	- - -	sandstone

D. Engineering description of injection units

1. Porosity:_____
2. Permeability:_____
3. Original Reservoir Pressure:_____
4. Reservoir Temperature_____
5. Chemical Character of Formation Water: Water sample from 3,120-3,167 analysis very similar to that reported for Ky-2.
6. Reservoir Fracture Pressure:_____

E. Geohydrology, fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality

F. Mineral Resources (oil and gas, coal, brines, etc.)

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface					
Intermed.					
Injection					
Other					

Describe bottom hole completion methods: open hole

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: _____

VI. Description of surface equipment

A. Holding tanks & flow lines _____

B. Filters _____

C. Pumps _____

D. Other _____

VII. Cores, sampler, & Log:

A. Coring

From	to	Recovery
"		
"		
"		
"		
"		
"		

B. Drilling Logs

X Drillers Log

X Sample log

___ Drilling time

___ Other: _____

VII. -- Cores, samples, & logs, continued

C. Other logs run

___ Resistivity	X Gamma ray-neutron
___ SP	___ Temperature
X Caliper	___ Cement bond

___ Other Synergetic, SNP, density, borehole compensated, sonic SDV, dual induction laterlog

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

B. Physical & chemical Description aqueous hydrochloric acid solution having a maximum concentration of 20wt. % S. G. 1.106, temp. 140°F. Waste will not have more than 100ppm "organics".

C. Volume

IX. Preinjection waste treatment

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results
Have not received			

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results

C. Injection rates and pressures

1. Rate

Date(s) _____ Average _____ Maximum _____

" _____ " _____ " _____

" _____ " _____ " _____

" _____ " _____ " _____

" _____ " _____ " _____

2. Pressure (well head _____ bottom hole _____)

Date(s) _____ Average _____ Maximum _____

" _____ " _____ " _____

" _____ " _____ " _____

" _____ " _____ " _____

" _____ " _____ " _____

I. Well operation & operating history

B. Description of operating program:

E. Operating problems:

II. Regulatory aspects

A. Construction requirements

B. Monitoring requirements

C. Restrictions on operating procedure

XII. Economics

A. Total and unit costs of construction

B. Operating costs

XIII. Source(s) of Information and Published References

Kentucky Geological Survey

WELL FILE NO. [illegible]

USP M. D. Well #1

I. Operating Company & General Well Location

Universal Oil Products Company

Brian Cobb Barton, Inclusive

(P. O. Box 1104, Irvington, Inglewood)

II. Well Location (Legal description)

NE¼ SW¼ North half of Section 29

Cobb Parish, Inclusive

(1 Mile Diagonal NW)

III. History, system planning, construction & operation.

1. December 15, 1949 - Contacted Louisiana Dept. of Conservation about drilling a water disposal well.

2. April 28, 1950 - Obtained a work permit from the La. Dept. of Conservation to drill a disposal well on USP.

3. June 1, 1950 to July 15, 1950 - Drilled to 2312' cased off surface water and cased well.

4. July 2, 1951 to August 7, 1951 - Completed surface equipment installation and attempted to inject at 2300' without success.

5. August 12, 1952 - Permission granted by Louisiana Dept. of Conservation to perforate at 2300' to 2320' in attempt to inject at this level.

6. September 27, 1952 - Completed perforating and began injection of water.

7. June 1, 1953 - Began pulling tubing in well.

8. August 15, 1953 - Completed tubing in well.

9. November 1, 1953 - Pump was put in to well to operate tubing in the hole to a depth of 1200'.

10. December, 1953 - Plans will be made [illegible] to no further injection.

IV. Geology & Hydrology

A. Geological conditions in vicinity. Approximate Plane of fresh water.

The well is located [illegible] Plane of the fresh water is [illegible] well. It is not [illegible] the [illegible] well. [illegible] specific gravity [illegible] of fresh water [illegible] Pleistocene age.

B. Geologic description of rock units penetrated by well
Rock Cuts (Duplicate copies included - yes ___ ; no ___).
(Ground elevation 3[illegible]) (Total well depth 2262)
Datum for depth measurement Derrick Floor

Name	Age	Depth (top)	Thick ness	Lithologic Description
Wilcox	Tertiary	Surface	850'	Sand and Shale
Arkadelphia	U. Cretaceous	850	130'	Limy Shale and Shale
Nacatoch	Late	980	30'	Sand and lime and shale
Saratoga and Marlbrook	Late	1010	240	Lime and shale
Annona	Late	1250	175	Lime
Ozan	Late	1425	65'	Limy Shale
Brownstown	Late	1490	175	Shale and Sandy Shale
Tokio	Late	1665	80	Shale and Sandy Shale and sand

C. Geologic description of injection units & confining units not in use

Rock Cuts

Name	Age	Depth (top)	Thick ness	Character and Areal Distribution
Nacatoch Sand	U. Cretaceous	980	30'	Continuous & Lat. Ext. in...

D. Engineering description of injection units
1. Porosity, %
A. Permeability, md
B. Critical pressure in psi, bottom hole
4. Reservoir temperature, °F
5. Chemical Properties of Injection Water: [illegible] ppm Cl
6. Reservoir fracture pressure, psi bottom

IV. Geology & Hydrology, continued 3.

E. Geohydrology, fresh water aquifers in vicinity

Name	Depth	Thick-ness	Character	Chemical Quality
Glens	87-1/2'	11'	Sandstone	50 ppm Cl

F. Mineral Resources (oil and gas, coal, metals, etc.)

No mineral resources are reported in the vicinity of the well.

V. Well Design and Construction

A. Casing, Tubing, and Cement

	Hole Dia	Casing or Tubing Size, Kind & Weight	Depth Set	Type & Amount of Cement
Surface	13-3/4"	9-5/8" 32.3# H-40	200'	N.A. (circ.)
Intermed.	8-3/4"	7" 20# J-55	2850'	N.A.
Injection	6"	4-1/2" 9.5# J-55	3175'	Class A, 17% salt (Set on Parker Zone)

Other Data

Injection tubing and annulus to be filled with Inhibited 9-1/2# brine

V. Well design and construction, continued 4.

B. Packers, centralizers, well head equipment, etc:

VI. Description of surface equipment

A. Mixing tanks & flow lines

B. Filters

C. Pumps

D. Other

VII. Logs, samples, & tests

A. Logging

From _____ to _____ Frequency

B. Sampling

_____ Cuttings taken _____ Drilling time

_____ Cores taken _____ Other

VII. -- Cores, samples, & logs, continued

C. Other logs run

_Yes_Resistivity _No_Gamma ray-neutron

_Yes_SP _No_Temperature

_No_Caliper _No_Cement bond

_No_Other

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Manufacture of aqueous solutions for the petroleum refining industry.

B. Physical & chemical characteristics Waste water having the following approximate analysis:

_No_ 10% by _____ of H2O

_Cu_ 0 ppm

_____ 0.1 ppm

_Cr_ 5.59 ppm

_Cl_ 1200 ppm

_Pb_ Not ppm

C. Volume [illegible] available presently on stand-by.

IX. Fresh water [illegible] _____ of control, oil skimming, septic tank treatment of sewage

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results
Injection	Not reported	3600'	Formation too tight for waste water injection

B. Treatments or Stimulation

Zones treated	Treatment Intervals	Description of Treatment and Results
3600' to 3615	Injection	Treated w/500 gal a 20% HCl1 which would accept waste water.

C. Injection rates and pressures

1. Rate

Date(s) Dec. 1961 to Average rate 160 BPD Maximum 160 BPD

Dec. 1961		

2. Pressure (well would take in by gravity 50 PSI)

Date(s) Dec. 1961 to Average 300 PSI Maximum 700 PSI

Dec. 1961	During injection	Factor

X. Well operation & operating history

B. Description of operating programs: Very little difficulty has been experienced in operating this well. As a result, continuous injection was possible without the need for any special operating techniques.

K. Operating problems: Two tubing leaks and one casing leak as listed in the well history section.

XI. Regulatory aspects.

A. Construction requirements: Special casing and cementing of the fresh water zone. Casing and cementing of the well casing in the injection formation.

B. Monitoring requirements: Continuous monitoring of injected waste water. Monitoring of the annular pressure between the tubing and the casing for tubing leaks.

C. Restrictions on operating procedures: None

XII. Economics

A. Total & unit costs of construction Accurate records are unavailable. Estimated total cost in 1962 to 1972 would be approximately $50,000. Unit costs are unavailable.

B. Operating costs Total cost of waste water disposal is about fifty cents per thousand gallons.

XIII. Source(s) of information and Published References None
Louisiana Geological Survey

WELL FILE NUMBER
UOP & G. Well #2 STATE 1-2

I. Operator Company & General Well Location

Universal Oil Products Company

Brian, Caddo Parish, Louisiana

(P. O. Box 1290, Shreveport, Louisiana)

II. Well location (legal description)

S 15 W T 19 S South half of Section 20

Caddo Parish, Louisiana

#2 Harte (Proved well)

III. History, station planning, construction & operation.

1. April 1, 1957 - Contacted Louisiana Dept. of Conservation about drilling U. O. Well #2 to 4075' and perforate between 3745' and 3872'.

2. April 8, 1957 - Received permit from the Louisiana Dept. of Conservation to drill U. O. Well #2 to 4075'.

3. July 8 1957 to July 11, 1957 - Set 16" to 2068' cased of surface water not cased well. Perforated from 3850' to 4014'.

4. June 30, 1961 to June 31, 1961 - Replaced tubing in well.

5. January 10, 1962 - Tubing broken.

6. March 14, 1970 - Tubing leaks.

IV. Geology & Hydrology

A. Regional geologic setting: Northeast flank of Saline uplift

The well is located on the northeast flank of the Saline uplift and the regional dip is to the southeast. The stratigraphic section consists of sands and clays of Miocene to Pleistocene age.

IV. Geology & Geohydrology, continued 2.

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included -yes ___; no x).

(Ground elevation 272) (Total well depth 2065)

Datum for depth measurement Kelly Floor

Name	Age	Depth (top)	Thickness	Lithologic Description
Miocene	Tertiary	Surface	830'	Sand and Shale.
Annona Chalk	U. Cretaceous	830'	115	Limy Shale and Shale
Marlbrook	Same	945'	365	Sand and Lime and Shale
Saratoga & Marlbrook	Same	1310	210	Lime and Shale
Annona	Same	1520	170	Lime
Ozan	Same	1690	95	Limy Shale
Brownstown	Same	1785	175	Shale and Sandy Shale
Tokio	Same	1960	105	Shale and sandy shale and Sand

C. Geologic Description of injection units & possible units not in use

Name	Age	Depth (top)	Thickness	Character and Areal Distribution
Marlbrook	U. Cretaceous	945	65	Continuous & Ark, Tex, La.

D. Engineering description of injection units

1. Porosity: 30%
2. Permeability: 1000 MD
3. Original Reservoir Pressure: 800 PSI
4. Reservoir Temperature:
5. Chemical Character of Formation Water: 10,000 PPM Cl
6. Reservoir Fracture Pressure: 800 PSI

IV. Geology & Geohydrology, continued

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thick-ness	Character	Chemical Quality
None				

F. Mineral Resources (oil and gas, coal, brines, etc.)

None

No mineral resources are reported in the vicinity of the well.

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing. Weight & grade		Size	Depth Set	Type & Amount of Cement
Surface	13-3/4"	N. A.	N. A.	9-5/8"	200'	Class A - 200 SKS
Intermed.	7-7/8"	N. A.	N. A.	7 1/2"	2069	Class A - 310 SKS
Injection	5"	6.5	J-55	2-1/2"	970	Quick-Set-75 SKS

Other None

Describe bottom hole completion method: Casing perforations

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: Cement Basket on 2-1/2" at 860'

VI. Description of surface equipment

A. Holding tanks & flow lines Surface storage pond with 3 inch PVC flow lines

B. Filters None

C. Pumps 100 GPM Triplex injection pump

D. Other None

VII. Cores, samples, & Logs

A. Coring

From None to Recovery

"

"

"

"

"

B. Drilling Logs

No Drillers log No Drilling time

No Sample log No Other

VII. ... (odor, color, ...)

E. Other tests ...

...

...

...

...

...

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

...

B. Physical & chemical Characteristics ...

...

...

...

...

...

...

C. Volume ...

IX. Precautions taken ... during ... of waste.

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results
Tubing	Not recorded		Tubing was found to be intact
Tubing	Not recorded		Tubing was found to be intact

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results
None		

C. Injection rates and pressures

1. Rate

Date(s) August 1957 Average 0 GPM Maximum 100 GPM
" to present " " "
" " " " "
" " " " "
" " " " "

2. Pressure (well headout in 100 PSI bottom hole)

Date(s) August 1957 Average 500 PSI Maximum 700 PSI
" to present " during " during
" " " injection " injection
" " " " "
" " " " "

X. Well operation & operating history

D. Description of operating program: Very little difficulty has been experienced in operating this well. As a result continuous injection was possible without the need for any special operating techniques.

E. Operating problems: Tubing parted at top of well and string was in the hole. Tubing was replaced as listed in the well history section.

XI. Regulatory aspects.

A. Construction requirements: Special casing and cementing of the fresh water zone. Casing and cementing of the well casing to the injection formation.

B. Monitoring requirements: Continuous monitoring of the injected waste water. Monitoring of the annulus between the tubing and the casing for tubing leaks.

C. Restrictions or operating procedure: None

XII. Economics

A. Total & unit costs of construction Total cost of this disposal facility was approximately $40,000.00. Unit costs are not available.

B. Operating costs Total cost of waste water disposal is about fifty cents per thousand gallons.

XIII. Source(s) of Information and Published References None
Louisiana Geological Survey

WELL FILE NO. [illegible]
SCS U. S. Well #1

I. Operating Company & Original Well Location

Universal Oil Products Company
Drlg. Dept. Baton Rouge, Louisiana
(P. O. Box [illegible], Shreveport, Louisiana)

II. Well location (legal description)

[illegible] 1320 ft. North Half of Section 29
[illegible] Parish, Louisiana
[illegible] Range [illegible] W.

III. History, special planning, construction & operation.

1. Permit [illegible] Application for Permit, Notice of Conservation about drilling
U. S. Well #1
2. Permit [illegible] [illegible] well from the Louisiana Dept. of Conservation
3. Cement [illegible] [illegible] Head off sand, salt water and mud
4. Surface [illegible] Cement U. S. Well #1 by circulating in [illegible] sacks of cement [illegible]
5. Cement [illegible] [illegible]
6. Mud [illegible] [illegible] well.

IV. Geology & Correlation

A. Regional [illegible] Southeast flank of Sabine uplift.
The well is located on the Southeast flank of the Sabine uplift and the producing [illegible] is to the southeast. The stratigraphic section consists of sands and clays of Miocene to Pleistocene age.

B. Geologic description of rock units penetrated by well
Rock Unit (Geologic Name included -yes ___; no x).
(Ground elevation GP) (Total well depth 1100)
Datum for depth measurement

Name	Age	Depth (top)	Thick ness	Lithologic Description
Alluv	Tertiary	Surface	345	Sand and shale
Pendelphia	U-Cretaceous	345'	655	Silty Shale and Shale
Navarro	Cret	970	130	Sand and lime and Shale

C. Geologic description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thick ness	Character and Areal Distribution
Navarro	Cretaceous	970	60'	Continuous Ark. Tex. La.

D. Engineering description of injection units

1. Porosity: N/A
2. Permeability: N/A
3. Original reservoir pressure: 800 PSI
4. Reservoir temperature: N/A
5. Chemical description of formation water: 30,000 PPM Cl
6. Reservoir fracture pressure: 800 PSI

IV. Geology & Geohydrology, continued

B. Geohydrology (fresh water aquifers in vicinity

Name	Depth	Thick-ness	Character	Chemical Quality
Miles	11	10'	Sandstone	90 PPM Cl

F. Mineral Resources (oil and gas, coal, brines, etc.)

None

No mineral resources are reported in the vicinity of the well.

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing Wt. lb/ft	Grade	Cplg	Depth Set	Type & Amount of Cement
Surface	20"	65#	N.A.		300'	Class A - 300 SKS
Intermed.	15"	40.5#	N.A.	IC	3/4 1002'	Class A - 700 SKS
Injection	10"	32#	N.A.	8-5/8"	962	Class A - 675 SKS
Other	6-5/8" Tubing swung at 950'					

Describe bottom hole completion method: Casing perforations

V. Well design and construction, continued 4.

5. Packers, Centralizers, well head equipment, etc: _____

Halliburton Packer Shoe at 943'

VI. Description of surface equipment

A. Holding tanks & flow lines Underground vault for concrete pits and steel storage tank with 6 inch IPS flow lines.

B. Filters None

C. Pumps #3 and #4 Waste disposal wells have common pumps.

D. Other None

VII. Cores, samples, & Logs

A. Coring

From None to _____ Recovery _____

B. Drilling Logs

No Drillers Log

No Sample log

No Drilling time

No Other: _____

VII. -- Cores, samples, & logs, continued

C. Other logs run

Yes Resistivity — No Gamma ray-neutron

Yes SP — No Temperature

No Caliper — No Cement bond

No Other

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Manufacture of petroleum products for the petroleum refining industry.

B. Physical & chemical characteristics of waste water [illegible] the following approximate analysis

	[illegible]	pH	8.5
Ca	0		
SiO_4	34.2 ppm	Corrosion Inhibitor	200ppm
Cr	0.5+ ppm	Other Chemicals	370ppm
Ca	1270 ppm		
SO_4	201 ppm		

C. Volume 400 GPM average during injection. This well is spared with the #4 waste disposal well and only one well being used at a time.

IX. Preinjection waste treatment pH control, septic tank treatment of sewage.

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results
Tubing	not recorded		Tubing was found to have a hole was replaced

B. Treatments or Stimulation

Zones Treated	Treatment Applied	Description of Treatment and Results
None		

C. Injection rates and pressures

1. Rate

Date(s) January 1962 Average 600 GPM Maximum 700 GPM

" to present " (during injection) "

" " " "

" " " "

" " " "

2. Pressure (well head Shut in 350 PSI bottom hole 780 PSIG)

Date(s) January 1962 Average 600 PSI Maximum 800 PSI

" to present " during " during

" " injection " injection

" " " "

" " " "

X. Well operation & operating history

D. Description of operating programs: Very little difficulty has been experienced in operating this well. As a result, continuous injection was possible without the need for any special operating techniques.

E. Operating problems: A casing leak and a tubing leak as listed in the well history section.

XI. Regulatory aspects.

A. Construction requirements: Optical casing and cementing of the fresh water sands. Casing and cementing of the well casing to the injection formation.

B. Monitoring requirements: Continuous monitoring of injected waste water. Monitoring of the annulus between the tubing and the casing for tubing leaks.

C. Restrictions on operating procedure: None

XII. Economics

A. Total & unit costs of construction Total cost of construction of the well and piping was approximately $[illegible],000.00. Other related pumping and holding equipment cost approximately $100,000.00.

B. Operating costs Total cost of waste water disposal is about fifty cents per thousand gallons

XIII. Source(s) of Information and Published References None

Louisiana Geological Survey

WELL FILE NUMBER

UOP W. D. Well #4 STATE I-4 UMR

I. Operating Company & General Well Location

Universal Oil Products Company

Brian, Caddo Parish, Louisiana

(P. O. Box 1566, Shreveport, Louisiana)

II. Well location (legal description)

R15W T 19 N North half of Section 29

Caddo Parish, Louisiana

Waste Disposal Well

III. History, system planning, construction & operation.

1 Mar 3, 1967 - Contacted Louisiana Department of Conservation about drillin W. D. Well #4 to 1095'

2 Mar 26 1967 - Obtained work permit from the Louisiana Dept of Conservation to drill W. D. well to 1100'

3 July 10 1967 - to July 22 1967 - Drilled to 1090' Cased off surface water and cased well.

4. March 10, 1970 - Tubing tested

IV. Geology - Geophysics

A. Regional geological setting - Northeast Flank of Sabine Uplift.

The well is located on the northeast flank of the Sabine uplift and the regional dip is to the northeast. The stratigraphic section consists of sands and clays of Miocene to Pleistocene age.

IV. Geology & Geohydrology, continued 2.

B. Geologic description of rock units penetrated by well
Rock Unit (Geologic Column included yes ___ no X).
(Ground elevation 270) (Total well depth 1150)
Datum for depth measurement Derrick Floor

Name	Age	Depth (top)	Thickness	Lithologic Description
Wilcox	Tertiary	Surface	900'	Sand and Shale
Arkadelphia	U-Cretaceous	900'	160'	Lime Shale and Shale
Nacatoch	U-Cretaceous	1060'	150'	Sand and Lime and Shale

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thick-ness	Character and Areal Distribution
Nacatoch	U-Cretaceous	1060'	150'	Permeable - Ark, Tex, La

D. Engineering Description of Injection Units

1. Formation ___
2. Permeability ___
3. Original Reservoir Pressure ___ psi
4. Reservoir Temperature ___
5. Chemical Character of Formation Water: Na-Cl ppm Cl
6. Reservoir Fracture Pressure 800 psi

F. Geologic Formation Tops

Name	Depth Ft.	Elevation	Tested Quality
Miles	20'	Impervious	Dry Ft.

F. Depth Encountered (Ft. and Str. Head, Where, etc.)

None

No water encountered in the course of the drilling of the well.

V. Well Casing and Cementing

A. Casing, Tubing, and Liners

Kind	Size	Depth Ft.	Grade	Type & Amount of Cement
Surface	8"			Class A + [illegible]
Drive pipe				
Perforated	6"			Class A + [illegible]
Other	6.5"			

Detailed Casing Log: [illegible] Perforations from 20' to [illegible]

Mudding and Plugging: [illegible]

V. Well design and construction, continued

B. Packers, centralizers, well head equipment, etc: Centralizers on 5" at 500', 460', 380', 300', 220', 140'

Centralizers on 10-3/4" at 304', 264', 225', 184', 145', 105', 65'

VI. Description of surface equipment

A. Holding tanks & flow lines: Underground open top concrete pits and steel storage tank with 8 inch IPS flow lines

B. Filters: None

C. Pumps: [illegible] and [illegible] W. [illegible] centrifugal pumps 4 - 175 GPM injection pumps

D. Other: None

VII. Cores, samples and tests

A. Coring

From: None — Recovery:

B. Drilling

No. Deviation tests — No. Drilling time

No. Samples to — No. Other:

VII. -- Cores, samples, & logs, continued

C. Other logs run

Yes Resistivity — Yes Gamma ray-neutron

Yes SP — No Temperature

No Caliper — Yes Cement bond

No Other

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Manufacture of synthetic catalysts for the petroleum refining industry

B. Physical & chemical Description Waste water having the following approximate analysis

Na	1050 ppm		
Ca	0 ppm	pH	8.9
SiO_3	34[illegible] ppm		
Cr	0.[illegible] ppm	pentachlorophenol	200 ppm
Cl	3270 ppm	other cresolics	370 ppm
SO	901 ppm		

C. Volume 400 GPM during active injection. This well is spared with the [illegible] waste disposal well which only one well being used at a time.

IX. Preinjection [illegible] Primary septic tank treatment of sewage

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results
Tubing	not recorded		Tubing was found to be intact

B. Treatments or stimulation

Zones Treated	Treatment used	Description of Treatment and Results
None		

C. Injection rates and pressures

1. Rate

Date(s) August [illegible] Maximum 700 GPM

2. Pressure (Bottom hole 780 PSIG)

Date(s) August [illegible] Maximum 800 PSI during injection

X. Well operation & operating history

D. Description of operating programs: Very little difficulty has been experienced in operating this well. As a result, continuous injection was possible without the need for any special operating techniques.

E. Operating problems: None to date

XI. Regulatory aspects.

A. Construction requirements: Special casing and cementing of the fresh water zones. Casing and cementing of the well casing to the injection formation.

B. Monitoring requirements: Continuous monitoring of injected waste water. Monitoring of the annulus between the tubing and the casing for tubing leaks.

C. Restrictions on operating parameters:

XII. Economics

A. Total & unit costs of construction Total cost of completion of this well was approximately $100,000.00. Unit costs are unavailable.

B. Operating costs Total cost of waste water disposal is about fifty cents per thousand gallons.

XIII. Source(s) of Information and Published References None

Louisiana Geological Survey

WELL FILE NUMBER SWD #2 / STATE L-5 / UMR

I. Operating Company & General Well Location

Shell Oil Company

Norco Refinery

Norco, Louisiana

II. Well location (legal description)

Effluent Disposal Well #1

Sec. 6, T.14S, R.5E

Field - Shell Oil Company, Norco Refinery

Parish - St. Charles

III. History, system numbers, completion & operation.

Disposal well #1 was put in operation on 7/10/59 to handle all [illegible] were first processed by our three existing processing units. [illegible] was pumped into the well [illegible] and injected in the well at the [illegible]

[illegible] on 10/18/64 with an injection rate of [illegible] on 10/20/64 the well was packed off [illegible] pressure had increased to 80 psig [illegible] returned to 36 psig. The well was back [illegible] of operation. On 10/18/64 the well [illegible] the next five years, the well [illegible] moderate flows, but in 10/69 [illegible] and restricted at the [illegible] ft. level. [illegible] level was limited to approximately 200 [illegible] allowed to rise back after several backwashings. In July [illegible] and completely abandoned.

IV. Geology & Geophysics

A. Regional [illegible] 0' to 60', backswamp clays, etc.; 60'-1000', continental [illegible] sands, gravels and clays; 1000'-2500', continental [illegible] sands, gravels, some marine zones; 2500'-10,000', Miocene, marine, sands and shales. Regional structural dip: to SW @ 5-75'/mile lying on W [illegible] area cut by W trending normal faults, downthrow to SW up to 600'. Regional E-W system faults traverse area north of Norco, w/100'-300' displacements.

IV. Geology & Geohydrology, continued

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included -yes X ; no ___).

(Ground elevation 10 ft. ; (Total well depth 1910 ft.)

Datum for depth measurement 1' above rotary table @ 11'

Name	Age	Depth (top)	Thickness	Lithologic Description
Zone 1	Pliocene	1670'	130'	Sand, med. gr., unconsolidated
Zone 2	"	1300	100'	" " " "
Zone 3	"	1170'	90'	" " " "

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thickness	Character and Areal Distribution
Injection units described above are in the most favorable position.				
None considered.				

D. Engineering description of injection units

1. Porosity:

2. Permeability:

3. Original

(estimate based upon

4.

a.

Chemical character of formation water:

Brackish (at 1800 ft. salinity is approximately 15,000 ppm)

b.

6. Reservoir fracture pressure: Fracture pressure inapplicable to unconsolidated formation

IV. Geology & Geohydrology, continued

E. Geohydrology, fresh water aquifers in vicinity

Name	Depth	Thick.	Character	Chemical Quality
*"700' Sd."	700'	140'	Slightly brackish	600-2600 ppm Cl
"400' Sd."	350'	90'	Slightly brackish variable	175-1700 ppm Cl.
"200' Sd."	210'	160'	Slightly brackish variable	up to 650 ppm Cl.

*Brackish below 700'

*Salt water below 1000' (Sea level -40' below surface on "400' Sd.)

F. Mineral Resources (oil and gas, coal, brines, etc.)

No mineral resources at depths less than 2000' in this area.

Deepest well & plant is Disposal Well #5 @ 3500' +.

V. Well design and construction (See attached log & data, and sketch & Table, Typical Completed Well - Well No. 1*)

	Size	Depth	Type & Amount of Cement
Surface			35 Cement to surface
Intermed.			35 Cement + 2% CaCl to surface
Injection Str'g			35% Cement + 2% CaCl to surface
Other (Packer)			

Describe below hole completion, if applicable:

Perforated from 12[illegible]' to 13[illegible]' with 1/2" dia. holes per foot

V. Well design and construction, continued 4.

B. Packers, Centralizers, well head equipment, etc:

Centralizers @ 60 ft. intervals on bottom 500 ft. of 7 5/8" casing and @ 90 ft. intervals on remainder of string.

Well head - 6"-5000 tubing hanger (cameron iron works type "C D")

VI. Description of surface equipment (Well #1 never tied into below system)

A. Holding tanks & flow lines "Sour" water is drained from accumulators and reflux drums in processing unit areas, collected in a surge drum and pumped from the units to a refinery collection header which is the suction line for the main injection pumps. From these pumps the "sour" water is distributed to all the disposal wells.

B. Filters None

C. Pumps Two main service pumps rated at 1750 gpm at 375 psi differential pressure. Pumps can be operated individually, in parallel or in series.

D. Other Disposal system is instrumented to maintain main injection pump suction pressure at 100 psig by installation of control valves at each well which can be set to control flow at suction pressure. One well always set on pressure control and others on choke to maintain constant pump suction pressure. Line is also instrumented for each well.

VII. Cores, samples, & Logs

A. Coring (type)

From _____ To _____ Recovery _____

B. Drilling time (type)

_____ Wireline log _____ Drilling time

_____ Sample log _____ Other _____

VII. -- Cores, samples & logs, continued

C. Other logs run

__X__ Resistivity
__X__ SP
____ Caliper
____ Other

__X__ Gamma ray-neutron
____ Temperature
____ Cement bond

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Water from petroleum processing wells.

B. Physical & chemical characteristics

Spent water (stripping steam and formation water) with following characteristics:

1. Sulfides content, ppm - 1750
2. Phenols content, ppm - 21
3. Oil Content, ppm - 700
4. Suspended solid content, ppm - 120
5. pH - 8.5

C. Volume and quality of this well's waste in excess of the average injection values as given in the NOI #3.

IX. Reinjection well locations ____ Drilling and all stimulations

X. Well operation & operating history

A. Tests (& records)

Type	Duration	Zones tested	Description of test results

B. Treatments or Stimulation (& records)

Zones Treated	Treatment Intvl	Description of Treatment and Results

C. Injection rates and pressures (well shutdown ???)

1. Rate

Date(s) 3/11/[illegible] Average [illegible] gpm Maximum

" [illegible] " [illegible] "

" [illegible] " [illegible] "

" [illegible] " [illegible] "

" [illegible] " [illegible] "

2. Pressure (well head [illegible] psig (max) bottom hole [illegible] psig)? [illegible]

Date(s) 9/[illegible] Average [illegible] psig Maximum

" [illegible] " [illegible] psig "

" 4/1/67 " 184 psig "

" [illegible] " [illegible] psig "

" 9/13/69 " 183 psig "

7. Well completion & operating history

D. Description of operating programs: Well placed off and abandoned at present time. Unit will not in service, it took flow directly from one of the operating units. When injection pressure increased above desired level, the well was recharged until zone was clean as flushed with fire water.

E. Operating problems: Well had to be recharged on account of plug zone [illegible] before it was displaced.

8. Regulatory aspects.

A. Conservation requirements:

In relation with Division of Conservation's procedure to Discharge [illegible] to Pit.

In relation [illegible] Notice of Intention [illegible]

B. Discharge requirements: Notice will be received of the Board of Supervisors may [illegible] to discharge to Pit. Notice I and duty I to each pit [illegible] amount of water injected daily in [illegible] (2) [illegible] (3) [illegible]

C. Requirements [illegible]

XII. Economics

A. Total 3 well costs of construction

Well were including pump and piping = $32,000 (1978)

B. Operating costs recording that backwash are run = $120 and =

$200 per year

Approximate well pump energy energy point = $13,000 or $1,200/year

XIII. Source(s) of Information and Published References

(1) Geological Recommendations for Water Disposal at Dunn, Location,

(1977, DEM, 3 p., 1 fig, 2 well log) Report

(2) Soil Survey (Interim) Interpretations of Soil Qualities Maintenance,

(Dunn, DEM, 5 p., 1 table, 2 well log) Report

I. Operating Company & General Well Location

II. Well Location (Legal description)

III. History, system planning, construction & operation.

IV. Design & Capability

1. Regional geologic setting:

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included -yes X ; no ___).

(Ground elevation 10 ft.) (Total well depth 1934 ft.)

Datum for depth measurement 6' above ground level

Name	Age	Depth (top)	Thickness	Lithologic Description
Zone 1	Pliocene	1830	50'	Sand, med. gr., uncemented
Zone 2	"	1660	150'	" " " "
Zone 3	"	1440	50'	" " " "

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thickness	Character and Areal Distribution
Injection units described above. See log for stratigraphic position.				
None considered.				

D. Engineering description of injection units

1. Porosity: 30-34%
2. Permeability: 1 - 3 darcies
3. Original Reservoir Pressure: 1 pt. 840 psi @ 1800 ft.
   (Estimate based upon a pressure gradient of .45 psi/ft.
4. Reservoir temperature: (0° only)
5. Chemical Character of Formation Water:
   Brackish (below 2000 ft. salinity is approximately 15,000 ppm)
6. Hydraulic fracture pressure: Fracture pressure impossible to ascertain in unconsolidated formation.

IV. Geology & Geohydrology, continued

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality
*"700' Sd."	680'	100'	Slightly brackish	600-2600 ppm Cl.
"400' Sd."	350'	80'	Slightly brackish variable	175-1700 ppm Cl.
"200' Sd."	210'	70'	Slightly brackish variable	up to 650 ppm Cl.

*Brackish below 740'

*Salt water below 1000' (FW level ±40' below surface on "400' Sd.)

F. Mineral Resources (oil and gas, coal, brines, etc.)

No mineral resources occur at depths less than 5000' in this area, Deepest well @ plant is Disposal Well #5 @ 3500 ft.

V. Well design and construction (See attached drawing B-119-C)

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing: Wt./ft., Grade, & Type	Depth Set	Type & Amount of Cement
Surface				
Intermed.	12 1/4"			
	9 1/8"			
Injection	7"			

Other (Packer setting, etc.)

Describe bottom hole completion method:

If multiple perforations, ft. from ft. to ft.

V. Well design and construction. continued 4.

B. Packers, Centralizers, well head equipment, etc: Packer, 5" OD x 7" OD type TS-8 RE TWO for 7" OD 17#/ft. casing. (installed 1/69, abandoned 2/69).

Centralizers - Halliburton S-3 centralizers on bottom 3 joints of 9 3/8" casing.

Well Head - 7" flange and tubing hanger API 900 R-45

VI. Description of surface equipment

A. Holding tanks & flow lines "Sour"water is drained from accumulators and reflux drums in processing unit areas, collected in a surge drum and pumped from the units to a refinery collection header which is the suction line for the main injection pumps. From these pumps the "sour" water is distributed to all the disposal wells.

B. Filters None

C. Pumps Two pumps capable of pumping 1200 gpm at 125 psi differential pressure. Pumps can be operated individually, in parallel or in series.

D. Other Disposal system is instrumented to maintain main injection pump suction pressure at 100 psig by installation of control valves at each well which can be set to control flow or suction pressure. One well always set on pressure control and others on flow to obtain constant pump suction pressure. Flow is also controlled for each well.

VII. Cores, samples, & logs

A. Cores (none)

From _____ ft. to _____ Recovery _____

B. Drilling time (none)

Electric log _____ Drilling time

Sonic log _____ Paper

VII. -- Cores, samples & logs, described

C. Other logs run

X Resistivity
X SP
____ Caliper
X Other Casing inspection

__X__ Gamma ray-neutron
____ Temperature
__X__ Cement bond

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Water from petroleum processing units.

B. Physical & chemical Description

Sour water (stripping steam and desalter water) with following characteristics

1. Sulfides content, ppm - 1150
2. Phenols content, ppm - 55
3. Oil content, ppm - 200
4. Suspended solids content, ppm - 121
5. pH - 8.

C. Other pollutants

D. Prior treatment [illegible]

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results
Inj. test (after 11/66 work over)	few minutes	Zone 1	250 gpm @ 40 psig

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results
1/68 Zone 1	15% Fe acid	Pump 2000 gal. acid @ 1 BPM - Max. pressure 50 psi.
1/69 Zone 1	15% Fe acid	Pump 2000 gal. acid @ 1 BPM - Max. pressure 50 psi.
9/3/69 Zone 1	Injection of SSP FLO S-20 followed by 400 gal. water	Injected 2 drums @ 40 gpm - pressure before = 190, after = 150
7/9/69 Zone 1	SSP FLO S-20 followed by 400 gal. water	Injected 4 drums @ 40 gpm - pressure before = 250, after = 295 (@ 250 gpm)

C. Injection rate and pressures (@ 1,360-1,860 ft. level)

1. Rate

Date(s)		Average		Maximum
3/20/71		115 gpm		120 gpm
4/1[illegible]		[illegible] gpm		200 gpm
5/[illegible]		[illegible]		101 gpm
[illegible]		[illegible]		93 gpm
[illegible]		[illegible]		134 gpm

2. Pressure (well head [illegible] psig level) bottom hole 2[illegible] psig)

Date(s)		Average		Maximum
3/20/71		[illegible] psig		120 psig
4/[illegible]/71		232 psig		233 psig
5/[illegible]/71		111 psig		125 psig
7/[illegible]/71		99 psig		210 psig
8/[illegible]/71		126 psig		130 psig

X. Well operation & operating history

D. Description of operating programs: A minimum flow of 30 gpm is maintained down the well at all times except during backwash. If flow down well is stopped for any reason, firewater is injected to maintain flow. When the well injection pressure increases beyond a 1 psi/1 mo rate, the well head is pressured to 600 psi with the system pumps in series. If this fails to clean the well, it is then backwashed.

E. Operating problems: From original startup of well to the 1/69 work over the high inflow of sands caused a continual problem which resulted in backwashing well and it once/month. Also coupled with the inflow of sands was the high level of solids and oil that were injected with the water at that time. Up to 47,000 ppm oil on 4/13/66 and up to 906 ppm suspended solids on 6/24/68.

XI. Regulatory aspects.

A. Construction requirements

1. Louisiana State Dept. of Conservation - Amendment to Statewide Order No. 29-B

2. Louisiana Geological Survey - Letter to Dept. of Conservation dated August 2, 1970, i.e., Approval Procedure for Waste Disposal Wells

B. Monitoring requirements: The State of Louisiana requires the following information be submitted by January 1 and July 1 of each year: (1) Average amount of waste injected daily in barrels, (2) Total amount of waste injected in the previous period, (3) Maximum injection pressure, (4) Chemical composition of waste.

C. Restrictions on [illegible]: None

XII. Economics

A. Total & unit costs of construction

Completed well cost (including pump, piping, etc.) - $34,000

B. Operating costs

Work over costs to date (9/7/71) approximately $50,000 (or approx. $750/yr)
Backwashing @ average of 10 times/year @ $100 per = $2,000/yr.

XIII. Source(s) of Information and Published References

(1) [illegible] Recommendations for Waste Disposal At Norco, Louisiana, August, 1969, W. G. Finch, Shell Oil Company

(2) Salt Water Disposal Theoretical Study of Water Quality Requirements, October, 1969, G. E. Mansfield, Shell Oil Company

SHELL FILE NUMBER

I. Operating Company & General Well Location

Shell Oil Company

Norco Refinery

Norco, Louisiana

II. Well location (legal description)

Effluent Disposal Well #3

Sec. 4, T.12S., R.5E.

Field - Shell Oil Company, Norco Refinery

Parish - St. Charles

III. History, system planning, construction & operation.

Disposal Well #3 was put in service on 10/13/65 to handle sour water produced by the Coker Unit which was completed at approximately that time. Sour water was collected in a holding tank and pumped directly to the well and injected at the 1600 ft. level. Original injection level was 100 gpm @ 50 psig.

On 11/26/65 the well was backwashed after the injection pressure had increased to 140 psig @ 96 gpm. After backwash injection ratio was 108 gpm @ 31 psig. Since 1965 well #3 has performed satisfactorily with periodic backwashing when pressure approached 140 psig. The well was tied into the new system described in section VI in 3/71. Since that time back flushing cycle has increased to about once per month.

IV. Geology & Geohydrology

A. Regional geologic setting: Surface to 60', backswamp clays, etc.; 60'-1000', continental Pleistocene, alternating sands, gravels and clays; 1000'-2500', continental Pliocene, alternating sands, gravels, some marine shales; 2500'-10,000', Miocene, marine, sands and shales. Regional structural tilt to SW @ 375'/mile. Lying on W flank of Garyville dome, cut by NW trending normal faults, downthrow to NE up to 600'. Regional E-W system faults traverse area north of Norco, w/100'-700' displacements.

IV. Geology & Hydrology, continued

B. Geologic description of rock units penetrated by well
Rock Unit (Geologic Column Included -yes X ; no ___).
(Ground elevation: 10 ft.) (Total well depth 1950 ft.)
Datum for depth measurements: 1.1 ft. above ground level

Name	Age	Depth (top)	Thickness	Lithologic Description
Zone 1	Pliocene	1850'	120'	Sand, med. gr., unconsol.
Zone 2	"	1410'	40'	" " " "
Zone 3	"	1150'	30'	" " " "

C. Geologic Description of injection units & possible units not in use

Name	Rock Unit Age	Depth (top)	Thickness	Character and Areal Distribution
Injection units described above. See log for stratigraphic position.				
None considered.				

D. Engineering description of injection units

1. Porosity: 30-32%

2. Permeability: 1-3 darcies

3. Original Reservoir Pressure: Est. 830 psi @ -1950 Ft.
(Estimate based upon a pressure gradient of .43 psi/ft.

4. Reservoir Temperature: (est. 98°F)

5. Chemical Character of Formation Water:
Brackish (below 2000 ft. salinity is approximately 35,000 ppm)

6. Reservoir Fracture Pressure: Fracture pressure inapplicable to unconsolidated formation.

IV. Geology & Hydrology, continued

A. Geohydrology, fresh water aquifers in vicinity

Name	Depth	Thick.	Character	Chemical Quality
*"1700' Sd."	1700'	150'	Slightly brackish	1000-1600 ppm Cl.
"1400' Sd."	1400'	150'	Slightly brackish wetsels	1171-1700 ppm Cl.
"1200' Sd."	1200'	40'	Slightly brackish wetsels	up to 1170 ppm Cl.

*Brackish below 740'

*Salt water below 1000' (WL level 540' below surface on 7-66 M.P.)

F. Mineral Resources (oil and gas, coal, brines, etc.)

No mineral resources occur at depths less than 3000' in this area.

Nearest well 3 plugged Mineral Well #3 @ 2567 ft.

V. Well design and construction (See attached Dwg. B-2784-3)

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing Weight & Grade	Casing Set	Depth Set	Type & Amount of Cement
Surface		54.5 lb/ft. Grade K-55		100 ft.	50-50 cement and Poz mix A
Intermed.	12 1/4"	24.0 lb/ft. K-55		1700 (1400) ft.	660 sacks
Injection	8 3/4"	17 lb/ft. K-55	7" OD	3000 ft.	660 sacks
Other (Backwash tubing)		4.7 lb/ft. J-55	2 3/8"	1648 ft.	

Describe bottom hole completion method:

Perforated with 4 1/2" dia. shots per foot at 1915 ft-1955 ft. level

V. B. Well design and construction, continued 2.

B. Packers, centralizers, well head equipment, etc: _____

Packers - None

Centralizers - Halliburton S-3 centralizers on Series I joints

Well Head - 7" flange and tubing hanger

VI. Description of surface equipment

A. Holding tanks & flow lines "Sour" water is drained from accumulators and valves & pumped in preserving unit space, collected in a sump drum and pumped from the unit to a refinery collecting header which is the suction line for the main injection pumps. From these pumps the "Sour" water is distributed to all the disposal wells.

B. Filters None

C. Pumps Two pumps capable of pumping 1767 gpm at 135 psi differential pressure. Pumps can be operated individually, in parallel or in series.

D. Other Disposal system is instrumented to maintain main injection pump suction pressure at 100 psig by installation of control valves at each well which can be set to control flow or suction pressure. One well allows for pressure control and three for flow to maintain constant pump suction pressure. Flow is also automatically totalized for each well.

VII. Cores, samples, & Logs

A. Coring (None)

From	To	Recovery
"		
"		
"		
"		
"		

B. Drilling Logs (None)

____Drillers Log ____Drilling time

____Sample log ____Other: _____

VII. -- Cores, samples, logs, continued

D. Other logs run

X Resistivity	Gamma ray-neutron
X SP	Temperature
X Caliper	Cement bond
Other	

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Water from petroleum production units

B. Physical & chemical Description Sour water (stripping steam and cooling water) with following characteristics:

1. Sulfide content, ppm - 1750
2. Phenols content, ppm - 55
3. Oil content, ppm - 10
4. Suspended solids content, ppm - 170
5. pH - 8.2

C. Volume 1400 BBL/Day

IX. Preinjection waste treatment Settling and oil skimming

X. Well operation & operating history

A. Tests

Type	Duration	Zones Tested	Description of test results
11/6/68 Injection	Few hours	Zone 1	0 to 1000 gpm @ 275 psi
			with freewater

B. Treatments to Stimulation

Zones Treated	Duration	Description of Treatment and Results
3/31/69 Zone 1	Injection [illegible]	Injected 2 - 55 gal drums @ 40 gpm
	followed by 30 bbls water	Pressure before = 130, after = 85
7/1/69 Zone 1	Same as above	Same as above except pressure
		after =90 psig
1/15/69 Zone 1	Same as above	Pressure before = 106, after = 110

C. Injection rates and pressures(@ 1915-1955 ft. level)

1. Rate

Date(s)		Average		Maximum	
2/[illegible]/71		[illegible] gpm		132 gpm	
4/[illegible]/71		[illegible] gpm	"	159 gpm	
" 5/[illegible]/71		[illegible] gpm	"	90 gpm	
" 7/2/71		[illegible] gpm	"	234 gpm	
" 8/[illegible]/71		[illegible] gpm	"	189 gpm	

2. Pressure (well head 130 psig (ave.) bottom hole 980 psig)

Date(s)		Average		Maximum	
2/[illegible]/71		112	"	155	"
" 4/[illegible]/71	"	232	"	235	"
" 5/[illegible]/71	"	143	"	150	"
" 7/2/71	"	78	"	90	"
" 8/[illegible]/71	"	42	"	70	"

X. Well operation & operating history

B. Description of operating programs: A minimum flow of 30 gpm is maintained down the well at all times except during backwash. If flow down well is stopped for any reason, firewater is injected to maintain flow. When the well injection pressure increases beyond a 1 gpm/1 psi ratio, the well head is pressured to 400 psi with the system pumps in series. If this fails to unplug the well, it is then backwashed.

E. Operating problems: No significant problems except periodic backwashing.

XI. Regulatory aspects.

A. Construction requirements: 1) Louisiana State Dept. of Conservation - Amendment to Statewide Order No. 29-B

2) Louisiana Geological Survey - Letter to Dept. of Conservation dated August 5, 1970, i.e., Approval Procedure for Waste Disposal Wells

B. Monitoring requirements: The State of Louisiana requires the following information be reported January 1 and July 1 of each year: (1) Average amount of waste injected daily in barrels. (2) Total amount of waste injected in the six-month period. (3) Cumulative total of injected waste. (4) Chemical composition of waste.

C. Restrictions on operating procedure: None

XII. Economics

A. Total & unit costs of construction Approximate cost to Install well (not including pumps, piping, etc.) - $40,000.

B. Operating costs Assume present backflushing cycle of approximately 10 times per year @ $200 per = $2,000 per year

XIII. Source(s) of Information and Published References

(1) Geological Recommendations for Waste Disposal at Norco, Louisiana, August, 1969, W. C. Finch, Shell Oil Company

(2) Salt Water Disposal Theoretical Study of Water Quality Requirements, October, 1969, C. R. Mansfield, Shell Oil Company

WELL FILE NUMBER SWDR #16 / STATE L-8 / UMR

I. Operating Company & General Well Location

Shell Oil Company
Norco Refinery
Norco, Louisiana

II. Well location (legal description)

Effluent Disposal Well #4
Sec. 6, T.12S, R.8E
Field - Shell Oil Company, Norco Refinery
Parish - St. Charles

III. History, system planning, construction & operation.

Disposal Well #4 was put in service in approx. 8/67 to handle sour water produced by the Ethylene Plant which had just been constructed. Sour water was collected in a unit holding tank and pumped directly to the well and injected at the 1900 ft. level.

Since Disposal Well #4 was put in service, it has performed satisfactorily with periodic backwashing (approx. 2 times per year). The well was tied into the new system described in section VI in 3/71.

IV. Geology & Geohydrology

A. Regional Geological setting: Surface to 60', backswamp clays, etc.; 60'-1000', continental leistocene sands, gravels and clays; 1000'-2500', continental Pliocene, as above, no gravels, some marine shales; 2500'-10,000', Miocene, marine, sands and shales. Regional structural tilt to SW @ ±75'/mi. Lying on W flank of Goodhope dome area cut by NW trending normal faults, downthrow to NE up to 600'. Regional E-W system faults traverse area north of Norco, w/100'-700' displacements.

IV. Geology & Geohydrology, continued 7.

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included yes X ; no ___).

(Ground elevation 10 ft.) (Total well depth 2029 ft.)

Datum for depth measurement 5 ft. above ground level

Name	Age	Depth (top)	Thickness	Lithologic Description
Zone 1	Pliocene	1900'	90'	Sand, med. gr., uncemented
Zone 2	"	1340'	60'	" " " "

C. Geologic Description of Injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thickness	Character and Areal Distribution
Injection units described above. See log for stratigraphic position.				
None considered.				

D. Engineering description of injection units

1. Porosity: 30-32%

2. Permeability: 1.5 darcies

3. Original Reservoir Pressure: 880 psi @ 1950 ft.

(estimate based upon .45 pressure gradient .45 psi/ft.)

4. Reservoir Temperature: 98°F)

5. Chemical Character of Formation Water:

Brackish (below 2000 ft., salinity is approximately 35,000 ppm)

6. Reservoir Fracture Pressure: Fracture pressure inapplicable to unconsolidated formation.

IV. Geology & Geohydrology, continued 3.

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality
*"700' Sd."	700'	110'	Slightly brackish	600-2600 ppm Cl.
"400' Sd."	350'	80'	Slightly brackish variable	175-1700 ppm Cl.
"200' Sd."	210'	160'	Slightly brackish variable	up to 650 ppm Cl.

*Brackish below 760'

*Salt water below 1000' (FW level ± 40' below surface on "400' Sd.)

F. Mineral Resources (oil and gas, coal, brines, etc.)

No mineral resources occur at depths less than 5000' in this area.

Deepest well @ plant is Disposal Well #5 @ 3500 ft.

V. Well design and construction (See attached Dwg. B-3791-1)

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing: Wt. & Grade	Size	Depth Set	Type & Amount of Cement
Surface		35 lb/ft, drive pipe		100 ft.	
Intermed.	12 1/4"	32.3 [illegible]	[illegible]	1000 ft.	Cemented to surface
Injection	8 3/4"	17 [illegible]	[illegible]	2000 ft.	Cemented to surface
Other (Backwash tubing)		4.7 lb/ft. J-55	2-3/8" OD	+1500 ft.	

Describe bottom hole completion method: Perforated at 4 - 1/2" dia. shots per foot at 1940 ft. to 1960 ft. level.

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc:

Packers - none

Centralizers - Halliburton S-3 centralizers on bottom 3 joints of 9 5/8" casing

Well Head - 7" flange and tubing hanger

VI. Description of surface equipment

A. Holding tanks & flow lines "Sour" water is drained from accumulators and reflux drums in processing unit areas, collected in a surge drum and pumped from the units to a refinery collection header which is the suction line for the main injection pumps. From these pumps the "sour" water is distributed to the disposal wells.

B. Filters: None

C. Pumps: Two pumps capable of pumping 1500 gpm at 1500 psi differential pressure. Pumps can be operated individually, in parallel or in series.

D. Other disposal system or equipment: To maintain main injection pump suction pressure at 100 psig by installation of control valves at each well which can be set to control flow at various pressures. One well always set on pressure control and opens or closes to maintain constant pump suction pressure. Flow is also automatically controlled for each well.

VII. Cores, samples & logs

A. Coring (None)

From ____ to ____ Recovery ____

" ____ ____ ____

" ____ ____ ____

" ____ ____ ____

" ____ ____ ____

" ____ ____ ____

B. Drilling logs (None)

____ Drillers log ____ Drilling time

____ Sample log ____ Other: ____

VII. -- Cores, samples, & logs, continued

C. Other logs run

X Resistivity	___ Gamma ray-neutron
X SP	___ Temperature
X Caliper	X Cement bond
___ Other	

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Water from petroleum processing wells.

B. Physical & chemical characteristics (after water settling steam and desalter water) with following characteristics:

1. Sulfide content, ppm - 1750
2. Phenols content, ppm - 81
3. Oil content, ppm - 50
4. Suspended solids content, ppm - 150
5. pH - 8.4

C. Volume 4800 bbl/day

IX. Preinjection waste treatment Settling and oil skimming

X. Well operation & operating history

A. Tests (None recorded)

Type	Duration	Zones tested	Description of test results

B. Treatments or stimulation (None recorded)

Zones Treated	Treatment interval	Description of Treatment and Results

C. Injection rates and pressures (Flowing tbg. level)

1. Rate

Date(s) 1/30/71 Average 177 gpm Maximum 180 gpm

" 4/19/71 " 223 gpm

" 5/10/71 " 140 gpm

" 5/20/71 " 136 gpm

" 6/9/71 " 135 gpm

2. Pressure (well head) (ft. above perforations) (1040 psig)

Date(s) 1/30/71 Average 197 psig Maximum 205 psig

" 4/19/71 " 212 psig " 225 psig

" 5/10/71 " 255 psig " 265 psig

" 5/20/71 " 213 psig " 250 psig

" 6/9/71 " 245 psig " 300 psig

. Well operation & operating history

D. Description of operating programs: A minimum flow of 30 gpm is maintained down the well at all times except during backwash. If flow down well is stopped for any reason, firewater is injected to maintain flow. When the well injection pressure increases beyond a 1 gpm/1 psi ratio, the well head is pressured to 400 psi with the system pumps in series. If this fails to unplug the well, it is then backwashed.

E. Operating problems: Since startup of the well, there have been no significant operating problems.

.I. Regulatory aspects.

A. Construction requirements 1) Louisiana State Dept. of Conservation - Amendment to Statewide Order No. 29-B

2) Louisiana Geological Survey - letter to Dept. of Conservation dated August 2, 1970, i.e., Approval Procedure for Waste Disposal Wells

B. Monitoring requirements The State of Louisiana requires the following information be reported January 1 and July 1 of each year: (1) Average amount of waste injected daily in barrels. (2) Total amount of waste injected in the statement period. (3) Cumulative total of injected waste. (4) Chemical composition of waste.

C. Restrictions on operating [illegible] None

XII. Economics

A. Total & unit costs of construction Approximate cost to install well (not including pumps, piping, etc.) - $4,400

B. Operating costs Assuming 2 backwashes per year @ $200 per = $400 per year

XIII. Source(s) of Information [illegible]

(1) Geological Recommendations for Waste Disposal at Weeks, Louisiana, August, 1969, W. C. Finch, Shell Oil Company

(2) Salt Water Disposal Theoretical Study of Water Quality Requirements, October, 1969, C. E. Mansfield, Shell Oil Company

WELL FILE NUMBER 711 STATE 4-9 JMR

I. Operating Company & Owners' Well Location

Shell Oil Company

Norco Refinery

Norco, Louisiana

II. Well location (legal description)

Effluent Disposal Well #5

Sec. 6, T.12S, R.8E

Field - Shell Oil Company, Norco Refinery

Parish - St. Charles

III. History, system planning, construction & operation.

Disposal Well #5 was drilled in late 1970, as part of an effluent improvements project that involved installation of two injection pumps (each 1200 gpm at 135 psig BP), a refinery sour water collection header (suction line for injection pumps), distribution piping from the pumps to all 4 wells and instrumentation to individually localize and control the flow of sour water to the wells.

Well #5 was drilled and cased to a depth of 3600 ft. The well is constructed with a tubing string set casing to a depth of 1000 ft. (through fresh water zones) and tubing string from 1000 ft. to 2040 ft. Backwash tubing is installed to 2040 ft. (without gas lift valves). The well is encased in cement from 2040 ft. to the surface.

The well was originally perforated at the 3500 ft. level, but attempts to inject at this level failed. This level was plugged and the 2700-2900 ft. level was perforated at 4 1/2" ϕ shots/ft. This proved unsatisfactory so perforations were increased to 8 1/2" ϕ shots/ft. Injection was initially good but when sand flow to the well could not be stopped during backwash, this level was plugged. The 2765-2925 ft. level was then perforated with 4 1/2" ϕ shots/ft. This level has proved satisfactory to date.

IV. Geology & Geohydrology

A. Regional geologic setting: Surface to 60', backswamp clays, etc.; 60'-1000', continental Pleistocene sands, gravels and clays; 1000'-2500', continental Pliocene, as above, no grafels, some marine shales; 2500'-10000', Miocene, marine, sands and shales. Regional structural tilt to SW @ ±75'/mile. Lying on W flank of Sedhope dome area cut by NW trending normal faults, downthrow to NE up to 600'. Regional E-W system faults traverse area north of Norco, w/100'-700' displacements.

IV. Geology & Geophysics, continued 3.

B. Geologic description of zone with penetrated by well

Name of [illegible] interval ~~zone~~ [illegible] ft.

(Ground elevation [illegible]) Total well depth [illegible]

Datum for depth measurement is [illegible]

Zone (Name)	Lithology	Depth (ft.)	Thickness (ft.)	Structural interpretation			
Zone 1	Missing	[illegible]	[illegible]				
Zone 2	Missing	[illegible]	[illegible]				
Zone 3	"	[illegible]	[illegible]	"	"	"	"
Zone 4	"	[illegible]	[illegible]	"	"	"	"
Zone 5	"	[illegible]	[illegible]	"	"	"	"
Zone 6	"	[illegible]	[illegible]	"	"	"	"
Zone 7	"	[illegible]	[illegible]	"	"	"	"
Zone 8	"	[illegible]	[illegible]	"	"	"	"
Zone 9	"	[illegible]	[illegible]	"	"	"	"

C. Geologic Description of injection units & [illegible] units in the

Pool Unit

Name	Top (ft.)	Depth Thickness (ft.)	Character and areal distribution
Injection units described above [illegible] the stratigraphic position.			
Name unidentified.			

D. Engineering description of injection units

1. Porosity [illegible]
2. Permeability [illegible]
3. Original formation pressure [illegible] (estimate based upon a hydrostatic gradient of [illegible])
4. Reservoir temperature [illegible]
5. Chemical analysis of formation water: Analysis [illegible] not available, unlikely to be obtainable in [illegible]
6. Reservoir fracture pressure: Fracture pressure unascertainable in unconsolidated formation.

V. Well design and construction, continued

B. Packers, centralizers, well head equipment, etc:

(1) Retrievable casing packer (Baker Model "G") on end of 7" OD casing for 9 5/8" casing.

(2) Centralizers - Halliburton S-3 (3 - 13 3/4" and 3 - 9 5/8")

(3) Well head equip. designed and supplied by Gray Tool Co. for our 13 3/8" x 9 5/8" x 7" well.

VI. Description of surface equipment

A. Holding tanks & flow lines "sour" water is drained from accumulators and reflux drums in processing unit areas, collected in a surge drum and pumped from the units to a refinery collection header which is the suction line for the main injection pumps. From these pumps the "sour" water is distributed to all the disposal wells.

B. Filters None

C. Pumps Two pumps capable of pumping 1200 gpm at 115 psi differential pressure. Pumps can be operated individually, in parallel or in series.

D. Other Disposal system is controlled to maintain main injection pump suction pressure at 100 psig by installation of control valves at each well which can be set to control flow or suction pressure. One well always set on pressure control and others to operate at constant pump suction pressure. Flow is also automatically recorded for each well.

VII. Logs, samples, & tests

A. Coring (none)

From	To	Recovery

B. Drilling tests (none)

Drillstem test Drilling time

Sample log Other:

VII. -- Cores, samples, & logs, continued

C. Other logs run

X Resistivity
X SP
Caliper
X Other Conductivity
X Gamma ray-neutron
Temperature
X Cement bond

VIII. Waste Characteristics

A. Industrial Process from which waste is derived
Water from petroleum processing units.

B. Physical & chemical Description Sour water (stripping steam and desalter water) with following characterisrics:

1. Sulfides content, ppm - 1750
2. Phenols content, ppm - 85
3. Oil content, ppm - 300
4. Suspended solids content, ppm - 120
5. pH - 8.6

C. Volume 8,600 bbls./day

IX. Treatment prior to disposal Settling and oil skimming.

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results
g.Test) Injection		3500 ft.(1)	Failed to inject at 1200 psig
Injection	5/15/71	2700-2900 ft.	126 gpm @ 290 psi @ 4 shots/ft. pe
Injection	5/25/71	2700-2900 ft. (2)	750 gpm @ 210 psi @ 8 shots/ft. pe
Injection	10/15/71	2165-2235 ft.	240 gpm @ 60 psi @ 4 shots/ft. per

(1) Plugged and abandoned after all attempts to inject failed.

(2) Plugged and abandoned when sand could not be stopped from flowing into well during backwash.

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results
2700-2900 ft.	4000 gal. of 15% HCl	Inject. rate poor, 126 gpm @ 290 psi
2700-2900 ft.	2000 gal. acid w/matrazine	Inject. rate very poor, 210 gpm @ 810 p
2700-2900 ft.	Backwashed	See note (2) in Section A
2165-2235 ft.	4000 gal. of 15% HCl	550 gpm @ 1150 psi
2165-2235	Backwashed	240 gpm @ 60 psi

C. Injection rates and pressures

1. Rate

Date(s)	10/15/70	Average		Maximum	240 gpm
"	10/30/70	"		"	233 gpm
"	3/20/71	"	220 gpm	"	238 gpm
"	5/10/71	"	178 gpm	"	180 gpm
"	8/3/71	"	227 gpm	"	279 gpm

2. Pressure (well head 212 psig (ave.) bottom hole 1192 psig)

Date(s)	10/15/70	Average		Maximum	60 psig
"	10/30/70	"		"	115 psig
"	3/20/71	"	190 psig	"	190 psig
"	5/30/71	"	242 psig	"	245 psig
"	8/3/71	"	205 psig	"	225 psig

V. Well operation & operating history

D. Description of operating programs: A minimum flow of 30 gpm is maintained down the well at all times except during backwash. If flow down well is stopped for any reason, firewater is injected to maintain flow. When the well injection pressure increases beyond a 1 gpm/1psi ratio, the well head is pressured to 400 psi with the system pumps in series. If this fails to unplug the well, it is then backwashed.

E. Operating problems: Well has performed satisfactorily since injection at 2165-2235 ft. level was started in 10/70. Well flow to pressure ratio has averaged approximately 1 gpm/1 psi but ratio can be increased to 2 gpm/1 psi by pressuring well head as described in section D. The well has only been backwashed once since 10/71. This increased the ratio to 3 gpm/1 psi. This ratio decreased over a period of two weeks back to the 1 gpm/1 psi ratio.

VI. Regulatory aspects.

A. Construction requirements 1) Louisiana State Dept. of Conservation - Amendment to Statewide Order No. 29-B

2) Louisiana Geological Survey - letter to Dept. of Conservation dated August 5, 1970, i.e., Approval Procedure for Waste Disposal Wells

B. Monitoring requirements The State of Louisiana requires the following information be reported January 1 and July 1 of each year: (1) Average amount of waste injected daily or monthly. (2) Total amount of waste injected in the six-month period. (3) Cumulative total of injected waste. (4) Chemical composition of waste.

C. Reporting requirements None

XII. Economics

A. Total & unit costs of construction

$125,000 - Disposal Well #5 Installation

$175,000 - Instrumentation, Collection & Distribution Piping and Main Injection Pumps

B. Operating costs Since well completed at 2165-2235 ft. level, operating costs have been nil. Thw work over costs involved in going from the 2700 ft. zone to the above zone was approximately $15,000.

XIII. Source(s) of Information and Published References

(1) Geological Recommendations for Waste Disposal at Norco, Louisiana, August, 1969, W. C. Finch, Shell Oil Company

(2) Salt Water Disposal Theoretical Study of Water Quality Requirements, October. 1969, G. E. Mansfield, Shell Oil Company

I. Operating Company & General Well Location

Shell Chemical Company, a Division of Shell Oil Company, Norco, Louisiana Plant. A 150 acre plant site adjacent to the Mississippi River and the east levee of the Bonne Carre' Spillway in Norco, Louisiana (St. Charles Parish).

II. Well location (legal description.)

Beginning at the Northwest corner Section 3 T 12S R 8E, thence S 10° 55' W along the section line between Sections 2 and 3 a distance of 5,920.2 feet to a point; thence S 83° 45' 40" E a distance of 779.5 feet to the point of location of well.

III. History; system planning, construction & operation.

This well was drilled in 1956 (Work Permit No. WW DW No. 83) to a total effective depth of 1920 feet in order to obtain information on and experience with the sub-surface disposal of waste streams. It was originally perforated with six 5/8" M-2 bullets per foot from 1860' to 1900'. Between 1956 and 1959 experiments were conducted injecting various waste water streams; however, the well was not used continuously for the disposal of any one or more streams. In 1960 the well was dedicated to the disposal of aqueous wastes from a new Acrolein/Glycerine manufacturing complex and now operates in parallel with two other wells (Nos. 2 & 3) in the same service. The three well system has a common surface treating system which normally has two wells in service with the third on standby. (See attached Drawing VP-11829-0 for well details.)

Geology : Geohydrology

A. Regional geology: surface to 0', backswamp clays, etc.; 0'-1000', continental Pliocene sands, gravels and clays; 1000'-2500', continental Pliocene, as above, w/ gravels, some marine strata; 2500'-10000', Miocene, marine, sands and shales. Regional structural dip to SW at ± 75'/mile on W flank of Gondwana dome area cut by NW trending normal faults, downthrows to NE up to 700'. Regional E-W system faults traverse area north of Norco, w/100'-700' displacements.

B. Geologic description of rock units penetrated by well
Rock Unit (Geologic Column included -yes X ; no).
(Ground elevation 10') (Total well depth 2216')
Datum for depth measurement 1' above Rotary Table at 11'.

Name	Age	Depth (Log)	Thickness	Lithologic Description
Zone 1	Pliocene	1670'	240'	Sand, med. gr., unconsolidated
Zone 2	"	1580'	60'	" " " "
Zone 3	"	1500'	50'	" " " "
Zone 4	"	1330'	70'	" " " "

C. Geologic description of injection units & possible units not in use

Rock Unit Name	Age	Depth (Log)	Thickness	Character and Areal Distribution
Injection units described above. See log for stratigraphic position.				
None considered.				

D. Engineering description of injection units

1. Porosity: 30-32%
2. Permeability: 1-5 darcies
3. Original Reservoir Pressure: (Est.) 810 psi at -1790'
4. Reservoir Temperature: 96° F (E. Log)
5. Chemical Character of Formation Water: Salt water ± 35000 ppm in injection zones. Typical Analysis - Specific Gravity - 1.05, pH - 7.2, Cl^- - 3.87%w, Ca - 0.27%w, Mg - 0.10%w, Na & K - 2.01%w, Total Dissolved Solids - 7.3%w, Silica - 29 ppm, Fe - 1 ppm, Al - 5 p SO_4 - 3 ppm, HCO_3 - 60 ppm, PO_4 - Nil, NO_3 - Nil.
6. Reservoir Fracture Pressure: No figure is applicable to these already unconsol. sds.

IV. Geology & Geohydrology, cont'd. 3.

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality
"700' Sd."	650'	140'	Slightly brackish	600-2000 ppm Cl.
"400' Sd."	320'	160'	Slightly brackish	variable 175-1700 ppm Cl.
"200' Sd."	210'	90'	Slightly brackish	variable up to 650 ppm Cl.

* Brackish below 740'
Salt water below 1000' (FW level ± 40' below surface on "400' sd.)

F. Mineral Resources (oil and gas, coal, brines, etc.)

No mineral resources occur at depths less than 9000' in this area.

Deepest well at plant is No. 1 waste water well at 3216'.

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing: Size & Weight	Grade	Depth Set	Type & Amount of Cement
Surface	16" OD	x 62.8 lb/ft		120'	Cemented to surface
Intermed.	10 3/4" OD	x 40.5 lb/ft		1960'	Cemented to surface
Production	7 5/8" OD	x 24 lb/ft		7 5/8"	7897'

(See attached Drawing 72-12[illegible]-0)

Bottom hole completion method: 10 3/4" casing plugged with concrete

V. Well design and construction, continued 4.

H. Packers, Centralizers, well head equipment, etc:

(See attached Drawing 71-1229-D)

VI. Description of surface equipment- Common System Serving 3 Wells

A. Holding tanks & flow lines Two 5,000 gallon carbon steel holding t

B. Filters - Primary filters - Three rotary vacuum 10' Diam. x 16' - 500 ft^2 each with associated filtrate, piping, and slurry handling facilities. Polishers Pall with 10 micron resin cartridge filter.

C. Pumps Two well injection pumps - each 700 gpm, 300 psi ΔP, cast iron with 15 HP drivers.

D. Other Instrument train with pump to return liquid to injection system after solids settle out.

VII. Cores, samples, & logs

A. Coring None

From	to	Recovery
"		
"		
"		
"		
"		

B. Drilling Logs

No drilling log ___ Drilling time

No time log ___ Other:

VII. --- Cores, samples, & logs, continued

C. Other logs run

Yes Resistivity — Yes Gamma ray-neutron

No SP — No Temperature

No Caliper — No Current tool

Other

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Manufacture of Acrolein, Acrolein, and Synthetic Glycerine.

B. Physical & chemical characteristics Typical stream data - Temp - 120°F, pH - 7, No suspended solids. Chemical Composition - 99 Water, 1% Soluble Organics. Exact organic breakdown of compounds present are Acrolein, Allyl Alcohol, Acetone, Methanol, Acetaldehyde, Methyl Ethyl Ketone, Glycerine, and related volatile esters and polymers which are reaction products of these compounds.

C. Volume One million gallons per day is normally injected into two wells operating in parallel with a third well in standby.

IX. Pre-injection waste treatment Filtration to remove solids larger than 10-20 microns in diameter.

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results
No data.			

B. Treatments or Stimulation

Zones Treated	Treatment Tried	Description of Treatment and Results
No data.		

C. Injection rates and pressures

1. Rate

Date(s)	Average	Intermitten	Maximum
1956-1959			
1960-Present	200	"	500
"	"	"	
"	"	"	
"	"	"	
"	"	"	

2. Pressure (well head _____ bottom hole _____)

Date(s)	Average	Maximum
1960 to present	120	175
"	"	"
"	"	"
"	"	"
"	"	"
"	"	"

X. Well operation & operating history

D. Description of operating program: This well is one of three in a common system. Normally, two are operated in parallel and the third is in standby. Injectivity of standby well is maintained by injecting a low flow of clarified Mississippi River water.

E. Operating problems: Well injection tip or the sand in the formation adjacent to the tip slowly plugs with organic polymer. When injection pressure increases from 90 psig at well head to 150 psig the well is taken out of service, backflushed, and placed in standby until needed. Each well is backflushed about every two weeks. About every two years each well is reworked and the injection tip is replaced.

XI. Regulatory aspects. Louisiana State Department of Conservation & Health Regulations:

A. Construction requirements

B. Monitoring requirements

C. Restrictions on operating procedure

XII. Schedule

A. Total & each cycle of construction [illegible]

B. Operating cycle [illegible]

XIII. Source(s) of Information and Technical Assistance

Written communication - [illegible]

I. [illegible]

II. [illegible]

III. [illegible]

IV. [illegible]

IV. Geology & Geophysics, continued

2.

B. Geologic description of each unit penetrated by well
Rock Unit (Geologic datum included: yes X ; no ___).
(Ground elevation ___ ft.) (Total well depth 2210')
Datum for depth measurements: 3' above Rotary table at 11'.

From	To	Thick. (ft.)	Thick. Penet.	Lithologic Description
Surface	Pliocene fill	200'	200'	Sand, red, & orange
Pliocene fill	"	1100'	40'	" " " "
"	"	1300'	90'	" " " "
"	"	1310'	20'	" " " "

C. Geologic description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (ft.)	Thick-ness	Character and Areal Distribution
Injection zone penetrated above, but log for stratigraphic section.				
None available				

D. Engineering description of injection units

1. Porosity: 34-38%
2. Permeability: 1-3 darcys
3. Original Reservoir Pressure: 1100 psi at -1190'
4. Reservoir temperature: 92° F (E. log)
5. Chemical character of formation water: Salt water @ 35000 ppm in injection zone. Typical analysis - Specific Gravity - 1.05, pH - 7.1, Cl - 1.47%, Ca - 0.12%, Mg - 0.10%, Na & K - 2.01%, Total Dissolved Solids - 3.1%, Silica - 10 ppm, Fe - 1 ppm, Al - 5 ppm, PO_4 - 1 ppm, HCO_3 - 60 ppm, CO_3 - Nil, SO_4 - Nil.
6. Reservoir Fracture Pressure: No figure is applicable to these sands as yet.

IV. Geology & Hydrology, continued

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thick-ness	Character	Chemical Quality
*"700' Sd."	650'	140'	Slightly brackish	600-2600 ppm Cl.
"400' Sd."	390'	160'	Slightly brackish variable	170-1700 ppm Cl.
"200' Sd."	240'	90'	Slightly brackish variable up to 550 ppm Cl.	

* Brackish below 740'
Salt water below 1000' (FW level ± 40' below surface on "400' Sd.)

F. Mineral Resources (oil and gas, coal, brines, etc.)

No mineral resources occur at depths less than 5000' in this area.
Deepest well at plant is No. 1 waste water well at 2216'.

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing: Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface	20"	16" OD x 62.8 lb/ft	16"	120'	Cemented to surface
Intermed.	15"	10 3/4" OD x 40.5 lb/ft	10 3/4"	1600'	
	15"	10 3/4" OD x 55 lb/ft	10 3/4"	1600-1900'	Cemented to surf.
Injection	10 3/4"	7 5/8" OD x 29.4 lb/ft	7 5/8"	1830	

Other (See attached drawing WP-11785-2)

Describe bottom hole completion method: (See attached drawing)

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: (See attached Drawing VP-13785-2)

VI. Description of surface equipment Common system serving three wells.

A. Holding tanks & flow lines Two 95,000 gallon carbon steel holding t

B. Filters Primary filters - Three rotary vacuum 10' Diam. x 16' - 500 ft^2 each with associated filtrate, precoat, and slurry handling facilities. Polish with 20 micron Cuno cartridge filter.

C. Pumps Two well injection pumps - each 700 gpm, 200 psi ΔP, cast iron with 125 HP drivers.

D. Other Backwash basin with pump to return liquid to injection system after solids settle out.

VII. Cores, samples, & Logs

A. Coring

From ____ to ____ Recovery ____

" ____ ____ ____

" ____ ____ ____

" ____ ____ ____

" ____ ____ ____

" ____ ____ ____

B. Drilling Logs

Yes Drillers Log

No Sample log

Yes Drilling time

Yes Other: Directional Drilling Lo

VII. --- Cores, samples, & logs, continued

C. Other logs run:

Yes Resistivity — Yes Gamma ray-neutron

No SP — No Temperature

No Caliper — No Cement bond

Other

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Manufacture of Acrolein, Acetone, and Synthetic Glycerine

B. Physical & chemical Description Typical Stream data - Temp - 120°F pH - 7, No suspended solids. Chemical Composition - 99% Water, 1% Soluble Organics. Exact organic breakdown is not known but compounds present are Acrolein, Allyl Alcohol, Acetone, Methanol, Acetaldehyde, Methyl Ethyl Ketone, Glycerine, and related soluble esters and polymers which are reaction products of these compounds.

C. Volume One million gallons per day is normally injected into two wells operating in parallel with a third well in standby.

IX. Preinjection waste treatment Filtration to remove solids larger than 10-20 microns in diameter.

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results
No data.			

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results
No data.		

C. Injection rates and pressures

1. Rate

Date(s) 1960-Present Average 200 Maximum 500

" " " " " "

" " " " " "

" " " " " "

" " " " " "

2. Pressure (well head _____ bottom hole _____)

Date(s) 1960 to present Average 120 Maximum 175

" " " " " "

" " " " " "

" " " " " "

" " " " " "

X. Well operation & operating history

D. Description of operating program : This well is one of three in a common system. Normally, two are operated in parallel and the third is in standby. Injectivity of standby well is maintained by injecting a low flow of clarified Mississippi River water.

E. Operating problems: Well injection tip or the sand in the formation adjacent to the tip slowly plugs with organic polymer. When injection pressure increases from 90 psig at well head to 150 psig the well is taken of service, backflushed, and placed in standby until needed. Each well is backflushed about every two weeks. About every two years each well is reworked and the injection tip is replaced.

XI. Regulatory aspects. Louisiana State Department of Conservation & Health Regulations.

A. Construction requirements

B. Monitoring requirements

C. Restrictions on operating procedure

XII. Economics

A. Total & unit costs of construction This well - $57,000 Surface Treatment system serving 3 wells operating in parallel - $340,000.

B. Operating costs The three wells operating in parallel and the common surface treatment system costs an estimated total $500,000 per year.

XIII. Source(s) of Information and Published References

Written communication - Louisiana Geological Survey

Well Plat Number 1 — Basic Data Sheet for Well No. 1 — L-12 — U-II

I. Operating Company & General Well Location

Shell Chemical Company, a Division of Shell Oil Company, Norco, Louisiana Plant. A 150 acre plant site adjacent to the Mississippi River and the east levee of the Bonnet Carre' Spillway in Norco, Louisiana (St. Charles Parish).

II. Well location (legal description)

Beginning at the Northwest corner Section 3 T 12S R 5E, thence S 10° 55' W along the section line between Sections 2 and 3 a distance of 5,920.2 feet to a point; thence S 63° 48' 40" E a distance of 774.4 feet; thence N 16° 51' E a distance of 30.0 feet to the point of location of the well.

III. History; system planning, construction & operation.

This well was proposed as a spare for Waste Water Disposal Wells Nos. 1 & 2 to be used for the disposal of process effluent from the Acrolein/Glycerine complex. The well was located 30 feet north of Disposal Well No. 2 and directionally drilled so that the bottom was approximately 300 feet west of the surface location. The well was drilled in October, 1964 to a total depth of 1960 feet. The original slotted injection zip and subsequent reworks and reperforations are shown on the attached drawing (VP-11832-2). The well now operates in parallel with two other wells (Nos. 1 & 2) in the same service. The three well system has a common surface treating system which normally has two wells operating in parallel with the third on standby.

IV. Geology & Geohydrology

A. Regional geologic setting: Surface to 60', backswamp clays, etc.; 60'-1000', continental Pleistocene sands, gravels and clays; 1000'-2500', continental Pliocene, as above, no gravels, some marine shales; 2500'-10000', Miocene, marine, sands and shales. Regional structural tilt to SW at ± 75'/mi lying on W flank of Goodhope dome area cut by NW trending normal faults, downthrow to NE up to 600'. Regional E-W system faults traverse area north of Norco, w/100'-700' displacements.

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included - yes X ; no).

(Ground elevation 10') (Total) well depth 2216')

Datum for depth measurement: 1' above Rotary Table at 11'.

Name	Age	Depth (top)	Thickness	Lithologic Description
Zone 1	Pliocene	1670'	240'	Sand, m-f. gr., unconsol.
Zone 2	"	1580'	60'	" " " "
Zone 3	"	1500'	30'	" " " "
Zone 4	"	1230'	70'	" " " "

C. Geologic Description of injection units & possible units not in use

Rock Unit Name	Age	Depth (top)	Thickness	Character and Areal Distribution
Injection units described above. See log for stratigraphic position. None considered.				

D. Engineering description of injection units

1. Porosity: 30-32%
2. Permeability: 1-3 darcies
3. Original Reservoir Pressure: (Est.) 810 psi at -1790'
4. Reservoir Temperature: 96° F (E. Log)
5. Chemical Character of Formation Water: Salt water ± 35000 pp in injection zones. Typical analysis - Specific Gravity - 1.05, pH - 7.2, Cl^- - 3.87%w, Ca - 0.27%w, Mg - 0.10%w, Na & K - 2.01%w, Total Dissolved Solids - 7.3%w, Silica - 20 ppm, Fe - 1 ppm, Al - 5 ppm, SO_4 - 3 ppm, HCO_3 - 60 ppm, PO_4 - Nil, NO_3 - Nil.
6. Reservoir Fracture Pressure: No figure is applicable to these already unconsol. sds.

IV. Geology & Geohydrology, continued

E. Geohydrology, fresh water aquifers in vicinity

Name	Depth	Thick. note	Character	Chemical Quality
"760' Sd."	650'	140'	Slightly brackish	600-2600 ppm Cl.
"400' Sd."	320'	140'	Slightly brackish variable	175-1700 ppm Cl.
"200' Sd."	210'	20'	Slightly brackish variable up to 650 ppm Cl.

Brackish below 210'

Salt water below 1000' (TW level ± 40' below surface on "400' Sd.)

F. Mineral Resources (oil and gas, coal, brines, etc.)

No mineral resources occur at depths less than 5000' in this area.

Deepest well at plant is No. 1 waste water well at 2216'.

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing: Weight & Grade	Size	Depth Set	Type & Amount of Cement
Surface		16" OD x 65 lb/ft	16"	92'	Cemented to surface
Intermed.		10 3/4" OD x 40.5 lb/ft	10 3/4"	1020'	Cemented to surface
Injection		7 5/8" OD x 26.4 lb/ft	7 5/8"	1528'	
		7" OD x 23.0 lb/ft	7	1528 to 1242	Cemented to 807

Other (See attached Drawing VP-1833-?)

Describe bottom hole completion method:

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: (See attached Drawing VP-11822-2)

VI. Description of surface equipment Common system serving three wells.

A. Holding tanks & flow lines: Two 95,000 gallon carbon steel holding tanks

B. Filters Primary filters - Three rotary vacuum 10' Diam. x 16' - 500 ft.^{2} each with associated filtrate, precoat, and slurry handling facilities. Polish with 70 micron Cuno cartridge filter.

C. Pumps Two well injection pumps - each 700 gpm, 200 psi ΔP, cast iron with 125 HP drivers.

D. Other Backwash basin with pump to return liquid to injection system after solids settle out.

VII. Cores, samples, & Logs

A. Coring

From	to	Recovery
"		
"		
"		
"		
"		
"		

B. Drilling Logs

Yes Drillers Log

Yes Sample log

Yes Drilling time

Other:

VII. -- Cores, samples, & logs, continued

C. Other logs run

Yes Resistivity
No SP
Yes Caliper
Yes Other Photoclinometer

Yes Gamma ray-neutron
Yes Temperature
No Cement bond

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Manufacture of Acrolein, Acetone, and Synthetic Glycerine

B. Physical & chemical Description Typical Stream data - Temp - 120°; pH - 7, No suspended solids. Chemical Composition - 99% Water, 1% Soluble Organics. Exact organic breakdown is not known but compounds present are Acrolein, Allyl Alcohol, Acetone, Methanol, Acetaldehyde, Methyl Ethyl Ketone, Glycerine, and related soluble esters and polymers which are reaction products of these compounds.

C. Volume One million gallons per day is normally injected into two wells operating in parallel with a third well in standby.

IX. Preinjection waste treatment Filtration to remove solids larger than 10-20 microns in diameter.

X. Well operation & operating history

A. Tests

Type	Duration	Dates Tested	Description of test results
No data.			

B. Treatments or Stimulations

Zones Treated	Treatment Used	Description of Treatment and Results
No data.		

C. Injection rates and pressures

1. Rate

Date(s) 1954 Present Average [illegible] Maximum [illegible]

2. Pressure (well head [illegible] bottom hole [illegible])

Date(s) 1954 to present Average [illegible] Maximum [illegible]

9. Well operation & monitoring schedule

a. Description of operating procedures. This well is one of three in a recharge system. Recharge can be carried on periodically and the third is in standby. Recharging of this well is accomplished by injecting a low flow of chlorinated municipal water.

b. Operating problems. Well injection may add to the formation sediment in the clay which clogs with organic matter. When injection pressure increases from 30 psi to well head to 100 psig the well is taken off service, backflushed, and placed in standby until needed. Each well is backflushed about every two weeks. About every two years each well is brushed and the injection rig is replaced.

10. Monitoring requirements Permits from Division of Conservation & Water Regulations.

a. Construction requirements

b. Monitoring requirements

c. Modifications or recording requirements

XII. Remarks

A. Total 1 unit costs of construction. This well - $42,000 Surface Treatment system serving 3 wells operating in parallel - $240,000.

B. Operating costs The three wells operating in parallel and the common surface treatment system have an estimated total $360,000 per year.

XIII. Source(s) of Information and Published References

Written communication - Louisiana Geological Survey

WELL FILE NUMBER HCl Disposal Well No. 1 / L-13
STATE / USGS

I. Operating Company & General Well Location

Shell Chemical Company, a Division of Shell Oil Company, Norco, Louisiana Plant. A 150 acre plant site adjacent to the Mississippi River and the east levee of the Bonne Carre' Spillway in Norco, Louisiana (St. Charles Parish).

II. Well location (legal description)

Beginning at the Northwest corner Section 3 T 12S R 8E, thence S 10° 55' W along the section line between Sections 2 and 3 a distance of 5,920.2 feet to a point; thence S 83° 48' E a distance of 1342.5 feet; thence N 16° 51' E a distance of 649 feet to the point of location of the well.

III. History; system planning, construction & operation.

This well was proposed for the disposal of aqueous hydrochloric acid. The well was drilled to a total depth of 1,740 feet in May, 1967. Operational difficulties were encountered until a polypropylene injection tip designed to keep sand out of the injection tubing was installed in August, 1968. The well is now used only when alternate uses are not available for the plant's by-product hydrochloric acid. The attached drawing (YP-697-3) shows the details of the well design and installation.

IV. Geology & Geohydrology

A. Regional geologic setting: Surface to 60', backswamp clays, etc.; 60'-1000', continental Pleistocene sands, gravels and clays; 1000'-2500', continental Pliocene, as above, no gravels, some marine shales; 2500'-10000', Miocene, marine, sands and shales. Regional structural tilt to SW at ± 75'/mile lying on S flank of Goodhope dome area cut by NW trending normal faults, downthrow to SW up to 600'. Regional E-W system faults traverse area north of Norco, w/100'-700' displacements.

IV. Geology & Geohydrology, continued

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included -yes X ; no).

(Ground elevation 10') (Total well depth 2216')

Datum for depth measurement 1' above Rotary Table at 11'.

Name	Age	Depth (top)	Thickness	Lithologic Description
Zone 1	Pliocene	1670'	240'	Sand, med. gr., uncemented
Zone 2	"	1580'	60'	" " " "
Zone 3	"	1500'	50'	" " " "
Zone 4	"	1230'	70'	" " " "

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thickness	Character and Areal Distribution
Injection units described above. See log for stratigraphic position.				
None considered.				

D. Engineering description of injection units

1. Porosity: 30-32%
2. Permeability: 1-3 darcies
3. Original Reservoir Pressure: (Est.) 810 psi at -1790'
4. Reservoir Temperature: 96° F (E. Log)
5. Chemical Character of Formation Water: Salt water ± 35000 pp in injection zones. Typical analysis - Specific Gravity - 1.05, pH - 7.2, Cl^- - 3.87%w, Ca - 0.27%w, Mg - 0.10%w, Na & K - 2.01%w, Total Dissolved Solids - 7.3%w, Silica - 20 ppm, Fe - 1 ppm, Al - 5 pp SO_4 - 3 ppm, HCO_3 - 60 ppm, PO_4 - Nil, NO_3 - Nil.
6. Reservoir Fracture Pressure: No figure is applicable to these already unconsol. sds.

IV. Geology & Geohydrology, continued

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality
*"700' Sd."	650'	140'	Slightly brackish	600-2600 ppm Cl.
"400' Sd."	320'	160'	Slightly brackish variable	175-1700 ppm Cl.
"200' Sd."	210'	90'	Slightly brackish variable	up to 650 ppm Cl.

* Brackish below 740'
Salt water below 1000' (FW level ± 40' below surface on "400' Sd.)

F. Mineral Resources (oil and gas, coal, brines, etc.)

No mineral resources occur at depths less than 5000' in this area.
Deepest well at plant is No. 1 waste water well at 2216'.

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing: Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface	22	16" OD x 62.6 lb/ft	16"	100'	Cemented to surface
Intermed.	16	11 3/4" OD x 42 lb/ft	11 3/4"	1000'	Cemented to surface
	12"	7" OD x 17 lb/ft	7"	1286'	
Injection					
Fibercast	12"	6 1/2" OD x 4.5 lb/ft	6"	1286 to 1730'	Cemented to surf
Injection	5	3 1/2" OD x 2.5 lb/ft Fibercast	1740		
Other	(See attached Drawing YP-697-3)				

Describe bottom hole completion method: (See attached drawing YP-697-3)

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: (See attached drawing YP-697-3)

VI. Description of surface equipment

A. Holding tanks & flow lines Plant HCl storage capacity is 64,000 gallons. Waste HCl is pumped through 2" plastic line to 650 gallon plastic surge tank and flows by gravity down well from surge tank.

B. Filters None

C. Pumps None

D. Other None

VII. Cores, samples, & Logs

A. Coring

From None to Recovery

" " "

" " "

" " "

" " "

B. Drilling Logs

Yes Drillers Log

Yes Sample log

Drilling time

Other:

VII. -- Cores, samples, & logs, continued

C. Other logs run

Yes Resistivity ____ Gamma ray-neutron

____ SP ____ Temperature

Yes Caliper Not needed Cement-bond

Yes Other Star recorder for directional drilling.

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Allyl chloride production unit

B. Physical & chemical Description 20° Baume' aqueous hydrochloric aci

C. Volume Injection rate has averaged 14,000 gallons per day over the last 2 1/2 years. The maximum short-term rate is 50,000 gallons per day.

IX. Preinjection waste treatment None - stream is a pure sales grade product.

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results
None			

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results
None		

C. Injection rates and pressures

1. Rate

Date(s) 6/68 to 1/71 Average 13 gpm Maximum 40 gpm

" " " " " "

" " " " " "

" " " " " "

" " " " " "

2. Pressure (well head _____ bottom hole _____)

Date(s) 6/68 to 1/71 Average 0 psig Maximum 20 psig

" " " " " "

" " " " " "

" " " " " "

" " " " " "

Well operation & operating history

B. Description of operating programs: This well is only used when alternate uses for the acid are not consuming production. During these periods excess is injected by gravity. Well is often in standby with no flow or injection.

E. Operating problems: None - Well is equipped with a patented rubber check valve which prevents sand from backing into the injection tube. As a result of this installation, the well can be blocked in and left in standby with no injection for extended periods.

XV. Regulatory aspects. Louisiana State Departments of Health and Conservation Regulations.

A. Construction requirements

B. Monitoring requirements

C. Restrictions on operating procedure

XII. Economics

A. Total & unit costs of construction $8),000

B. Operating costs This well costs an estimated $10,000 per year to operate.

III. Source(s) of Information and Published References

Written communication - Louisiana Geological Survey

WELL FILE NUMBER

Waste Disposal Well No. 1 STATE L-14 UMR

I. Operating Company & General Well Location

Tenneco Oil Company

Chalmette Refinery

Chalmette, Louisiana

II. Well location (legal description)

Begin at Louisiana Geodetic Survey monument coordinates x=2,430, 247.94 y=462,333.65 in Sect. 7, T 13S, R 12E, in St. Bernard Parish, Louisiana, thence due East 339.79 feet, thence due North 188.90 feet to location in Section T.

III. History, system planning, construction & operation.

A System Planning - A feasibility study was concluded to determine the following:

1. Formation suitable for disposal with impermeable confining beds, no lateral problems, and receiving formation with good thickness, areal extent, porosity and permeability.
2. Compatibility of waste stream with formation fluid.
3. Well location studies and materials of construction.

B. Construction

Construction started on 3/12/60 and was completed on 3/16/60.

C. Operation

Well designed to handle 300 gpm with expected flow of 150 gpm.

IV. Geology & Geohydrology

A. Regional geologic setting: The well is located along the southern margin of the Gulf Coastal Plain. The stratigraphic section consists of alternating sands and shales of Iocene to to recent age.

IV. Geology & Geohydrology, continued

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included--yes____; no____).

(Ground elevation_____) (Total well depth_____)

Datum for depth measurement_____

Name	Age	Depth (top)	Thick-ness	Lithologic Description
See IES Log Attached				

C. Geologic Description of injection units & possible units not in use

Rock Unit Name	Age	Depth (top)	Thick-ness	Character and Areal Distribution
Pliocene-Pleistocene		1850	120 Ft.	Blanket Sand

D. Engineering description of injection units

1. Porosity: 30%
2. Permeability: Unknown
3. Original Reservoir Pressure: 930 psi
4. Reservoir Temperature: Unknown
5. Chemical Character of Formation Water: Brine
6. Reservoir Fracture Pressure: Not Applicable

IV. Geology & Geohydrology, continued

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thick-ness	Character	Chemical Quality
See IES Log Attached				

F. Mineral Resources (oil and gas, coal, brines, etc.)

Brine

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing, Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface	12 1/4"	40.5# H-40	8 3/8"	47'	50 Sacks Type A
Intermed.					
Injection	9 7/8"	20#/Ft. J-55	7"	3016'	600 Sacks Type A
Other		6.7#/Ft. J-55, Hyd DZ	2 3/8"	1981'	Brine

Describe bottom hole completion method:

Perforated Casing 1955 1957 to 1959 Ft. 4 perforations per foot

Perforated Casing 1960 1960 to 1967 Ft. 4 hols/ft.

Perforated Casing 1962 1972 to 1973 ft.

V. Well design and construction, equipment

B. Packers, Centralizers, well head equipment, etc:

No Packer

Centralizers on 7" OD Casing

Well Head - RODGERS W.H. Flange with Companion RODGERS Flange

Screwed for 2 3/8"OD Tubing 2x4" Tie into Companion Screwed. Plug

valves and 1-2" Walworth Screwed Gate Valve, 2 Gateway line pipe couplings

VI. Description of surface equipment

A. Holding tanks & flow lines 7500 BBL Holding Tank

6" Waste Effluent Trunkline

B. Fillers None

C. Pumps One electric type for removal of holding tank.

D. Other All pipelines for Outreach for both wells

VII. Cores, samples, & Logs

A. Coring

From None to Temporary

B. Drilling Logs

Drillers Log

Sample Log

Drilling time

Other

VII. —

E. Other logic use

Electricity

X Ray

Pulsar

Gamma ray-neutron

Temperature

Inside Limb

VIII. Waste Characterization

A. Radioactive Drawings from which waste is derived

Detection Setting Various Units

B. Typical & Chemical Description These test circuit enter at varying

No. 1 No. 2 No. 3

C. Volume

IX. Modifications using Laboratory Time

8. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results
None			

B. Treatments or Stimulation

Zones Treated	Treatment Carried	Description of Treatment and Results
Zone each zone will be perforated with 4 JSPF at 120 deg. and 0.43" hole with 7.5 shots/ft.		
This zone on well gauged 1000 mcf formation gas because interior pressure problem.		

C. Injection Data and Procedures

1. Data

Date(s)	Interval	Maximum	Minimum

2. Pressure Tests and _____ Bottom Hole _____)

Date(s)	Interval	Maximum	Minimum

X. Well operation & operating history

D. Description of operating programs: Ow holding test with one pump injecting water into well.

E. Operating problems:

1. Well perforations plug; have to acidize or backwash well with air.

2. Plugged perforations and had to reperforate once.

3. Plugged two inch backwash tubing with sand and had to replace about 50' of pipe.

XI. Regulatory aspects.

A. Construction requirements: Permit obtained based on well casing pressure. Casing tested at 1000 psi for leaks.

B. Monitoring requirements: Annual report on injected volume and injection pressure.

C. Restrictions on operating procedure: None

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XII. Economics

A. Total & unit costs of construction

B. Operating costs

III. Source(s) of Information and Published References

Written communication - Louisiana Geological Survey

WELL FILE NUMBER

Waste Disposal Well No. 2 STATE L-15 UMR

I. Operating Company & General Well Location

Tenneco Oil Company

Chalmette Refinery

Chalmette, Louisiana

II. Well location (legal description)

313.16'E and 460.85'N From Louisiana Geodetic Survey Monument, located x=2,430,247.94', y=462,338.65' in Section 7, T13S, R12E, in St. Bernard Parish, Louisiana

III. History; system planning, construction & operation.

A. System Planning - A duplicate well to Well No. 1 was installed in the same service.

B. Construction

Construction started 1/26/63 and was completed 2/28/63

C. Operation

Averages flow [illegible] gpm

IV. Geology & Geohydrology

A. Regional geologic setting:

The well is located along the southern margin of the Gulf Coastal Plain. The stratigraphic section consists of alternating sands and shales of Iocene to Recent age.

V. Geology & Geohydrology, continued

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included--yes____; no____).

(Ground elevation_____) (Total well depth 2029)

Datum for depth measurement_____

Name	Age	Depth (top)	Thick-ness	Lithologic Description
Not Available - See Report for Waste Disposal Well No. 1				

C. Geologic Description of injection units & possible units not in use

Rock Unit Name	Age	Depth (top)	Thick-ness	Character and Areal Distribution
	Pliocene-Pleistocene			Blanket Sand
*See Report for Waste Disposal Well No. 1 the same sand is used as injection unit for both wells. Probably Top of Sand 1850 with 120 ft thickness.				

D. Engineering description of injection units

1. Porosity: 30%
2. Permeability: Unknown
3. Original Reservoir Pressure: 930 psi
4. Reservoir Temperature: Unknown
5. Chemical Character of Formation Water: Brine
6. Reservoir Fracture Pressure: Not Applicable

IV. Geology & Geohydrology, continued

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality
Not Available - See Report for Waste Disposal Well No. 1				

F. Mineral Resources (oil and gas, coal, brines, etc.)

Brine

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing: Weight & Grade	Size	Depth Set	Type & Amount of Cement
Surface Driven	[illegible]	[illegible]	11-3/4"	103'	----------
Intermed. 9 7/8"	20,22,26,29&32"/ft		7"	2209'	530 Sacks Class A
	[illegible]	[illegible]			+ 12% Gel + 2%CaCl
Injection	5.5#/ft,J-55 ERW		3 1/2"	1935'	----------

Other

Describe bottom hole completion method: After [illegible] Neutron Locator log, Well was perforated 1926-30' (4JSPF) and [illegible] 3 1/2" O.D. Casing with gas lift valves and mule shoe was set in the center of the perforated zone. 7" Csg. x 3 1/2" Csg. anul was annulled by anul receptacle at 1898' Perforations from 1926 to 1930'.

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc:

1-7"x5.25" I.D. seal receptacle set of 1835'

6-Centralizers (Weatherford-Bow), 2 on Float Jt., remaining @ 90' interval

14-Scratchers (Weatherford-Recip.), Every 20' from 2057' to 1700'

Wellhead-7" counterbore for weld x 4 1/2" type 6 National Casing head wit 8 5/8"x10" National series 600 x 900 Adapter flange.

VI. Description of surface equipment

A. Holding tanks & flow lines One 7500 BBL holding tank, disposal water pumped to well through 6" flow line.

B. Filters One Warner Lewis Model No. 4 MLL - 57PL liquid filter, 150 gpm max capacity, 300 psig max pressure. Used to filter water from backwash settling pond before reinjection into wells.

C. Pumps One electric centrifugal deep well pump for pumpout of holding tank, one union steam reciprocating for backwash settling pond pumpout with filter.

D. Other Backwash settling pond to allow foreign matter settlement from disposal well backwash before reinjection into disposal wells. Air compressor for backwashes.

VII. Cores, samples, & Logs

A. Coring

From_____ to_____ Recovery_____

"

"

"

"

"

B. Drilling Logs

___ Drillers log

___ Sample log

___ Drilling time

___ Other:

VII. -- Cores, samples, & logs, continued

C. Other logs run

x Resistivity
___ SP
___ Caliper
x Other

x Gamma ray-neutron
___ Temperature
___ Cement bond

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Petroleum Refining Process Units

B. Physical & chemical Description Three waste streams enter at varying rates and at different times. Well water analysis is as follows:

	No. 1	No. 2	No. 3
pH	8.6	8.4	8.3
Alkalinity, mg/l (As $CaCO_3$)	[illegible]	[illegible]	[illegible]
[illegible], mg/l	[illegible]	[illegible]	[illegible]
[illegible], %	[illegible]	[illegible]	[illegible]
[illegible], %	[illegible]	[illegible]	[illegible]

C. Volume 150 gpm

IX. Preinjection waste treatment None

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results
None			

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results
Once each year well is acidized with 8000 gals of 12% HCl and 3% H.F. Acid with F.E. additive. This cleans up well perforation and formation and decrease injection pressure required.		

C. Injection rates and pressures

1. Rate

Date(s) 1968 Average 150 gpm Maximum 300 gpm

2. Pressure (well head _____ Bottom Hole _____)

Date(s) _____ Average 50 Maximum 774 psi

X. Well operation & operating history

D. Description of operating programs: One holding tank with one pump injecting water into well.

F. Operating problems: Well perforations plug - have to acidize or backwash well with air to unplug.

XI. Regulatory aspects.

A. Construction requirements: Permit application based upon well casing program. Casing tested at 1500 psi for leaks.

B. Monitoring requirements: Annual report on volumes injected and injection pressure.

E. Restrictions on operating procedures: None

XII. Economics

A. Total & unit costs of construction

B. Operating costs

XIII. Source(s) of Information and Published References

Written communication - Louisiana Geological Survey

WELL FILE NO. [illegible]

I. Operating Company & Drilling Unit Location

Rosecliff - Fitz, Richard Assembly Facility

New Orleans, Louisiana

II. Well Location (Legal description)

East of Section 37 - T11S, R13E, New Orleans Base

Terminal Site No. Four, LPSC

III. History, system diagram, construction & operation

The Richard Chemical Disposal Well was activated in 1963 for the National Agricultural Rose Corporation to receive the solid and processed disposal of chemical waste from its Richard installation. Chemicals are used in neutralizing processes in the manufacture of various rose products at the Rose Primary Facility. The deep well chemical disposal system was installed and tested in the Industrial Center, Richard, 1964. The disposal method is designed to receive the solid processed disposal of chemical waste in aqueous solution of various rose and mineral products, and by permission of Parish [illegible]

The standard disposal well is 9,247 feet deep to more than 3,000 feet below the deepest fresh water-bearing subsurface formation at the Richard site. In addition to casing, the well was drilled nearly 1,000 feet deeper than the depth of cementation provided by a recommendation by a geological survey of the Richard area. This extra protective step is also now recommended by parish [illegible] and will be used on the new disposal as indicated. A new well was put into operation at the north of the main Richard plant. [illegible] Permission [illegible] was obtained.

IV. [illegible]

[illegible] clay and sand and [illegible] clay. From the surface to a depth of 30 feet, [illegible] a hole, size 17" to 18", [illegible] well casing [illegible] a depth from 67' to 70'.

[illegible] a depth from 70' to 104', [illegible] the depth below 70' has a weighted mud [illegible]. The well is [illegible] the different [illegible] of the well [illegible] [illegible] and [illegible] high [illegible].

[illegible] system elements, accessories & systems,
[illegible] field of [illegible]. Therefore, the [illegible] must pass [illegible] through the center axial plane [illegible] and accordingly horizontal.

The [illegible] shown in [illegible] [illegible] [illegible]

B. Geologic description of rock units penetrated by well bore (Indicate faults enclosed -yes___, no___).
(Ground elevation_____) (Total well depth_____)
Datum for depth measurements_____

Name	Age	Depth (ft.)	Thickness	Lithologic description

C. Geologic description of injection units & possible units not in use

Name Unit

Name	Age	Depth (ft.)	Thickness	Character and Areal Distribution

D. Engineering description of injection units
1. Porosity:_____
2. Permeability:_____
3. Original formation pressure:_____
4. Reservoir temperature:_____
5. Physical character of injection water:_____
6. Maximum fracture pressure:_____

IV. Geology & Geohydrology, continued

E. Geohydrology, fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality
----		100'	sand	High TDS

F. Mineral Resources (oil and gas, coal, brines, etc.)

Oil is produced in large amounts from numerous salt domes in the area.

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing Weight & Grade	Size	Depth Set	Type & Amount of Cement
Surface	15"	H-40 48#/ft. F.	11-3/8"	1200'	Trinity Lite Wat
Intermed.	10-5/8	J-55 26.4#/ft. F.	7-5/8"	6600	3118 Sacks
Injection			5 1/2"	6600	
Other					

Describe bottom hole completion method: Hole was under reamed and gravel packed with .030" - .060" gravel.

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: Packers 5½ Lynes special clearance external casing; centralizer casing 1-above float shoe 1-above float collar 1-per length of pipe up to 5,000 feet depth.

VI. Description of surface equipment

A. Holding tanks & flow lines Concrete holding pond 366' x 146', coated with an acide resistant epoxy cement.

B. Filters Two each, epoxy sand 1/2" thick, size of sand .030" - .040".

C. Pumps Oil well triplex plunger

D. Other Valves and piping

VII. Cores, samples, & Logs

A. Coring

From _____ To _____ Recovery _____

" _____ _____ _____

" _____ _____ _____

" _____ _____ _____

" _____ _____ _____

" _____ _____ _____

B. Drilling logs

X Driller's log

____ Sample log

X Drilling time

____ Other. _____

VII. -- Cores, samples, & logs, continued

C. Other logs run:

X Resistivity	X Gamma ray-neutron
SP	X Temperature
X Caliper	X Cement bond
X Other Casing collar log and perforating record.	

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

The chemical disposal system consists of underground gravity flow network and pressurized pipe systems through a series of chemical manholes and lift stations discharging directly into the two million gallon chemical holding pond.

B. Physical & chemical description The industrial waste is generated from metal surface treatment areas, tube and valve cleaning rooms, paint shops, machine and welding shops, laboratories, X-ray rooms and hydrostatic test areas, and other treatment areas.

C. Volume The daily average is 40,000 gallons of injected water-diluted chemical waste. Since February, 1964 through July 1971, 300 million gallons (± 5%) have been disposed of through the deep well method.

IX. Preinjection waste treatment No amount of oil and cyanide generated at Michoud are disposed by the well. These wastes are drummed and subsequently burned or chemically destroyed.

C. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results
None			

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results
One	Acidizing with 2% Acid	Well head pressure lowered as a result of treatment and injection rate increased.

C. Injection rates and pressures

1. Rate

Date(s)		Average		Maximum	
"	12-1-69	"	200	"	300
"	9-18-70	"	200	"	300
"	1-4-71	"	150	"	160
"	6-28-71	"	110	"	160

2. Pressure (well head X bottom hole)

Date(s)		Average		Maximum	
"	12-1-69	"	540	"	575
"	9-18-70	"	420	"	665
"	1-4-71	"	760	"	800
"	6-28-71	"	900	"	920

X. Well operation & operating history

D. Description of operating programs: Well is operated by Mason-Rust Operating Engineers and monitored twenty-four hours a day.

E. Operating problems: The main problem is that the well "sands up" and the pressure builds up. The well is back washed to reduce the pressure and put back in service.

XI. Regulatory aspects.

A. Construction requirements

B. Monitoring requirements

C. Restrictions on operating pressure and rate

XII. Economics

A. Total & unit costs of construction

Cost of Well #1 - $339,122.75

Cost of Well #2 - $483,765.15

B. Operating costs

Annual operating cost, cost of utilities not included $21,396.00

XIII. Source(s) of Information and Published References

Mason-Rust, NASA records.

WELL FILE NUMBER | Louisiana / STATE | L-17 / UMR

I. Operating Company & General Well Location

Beacon Gasoline Company - Section 26, Township 21 North, Range 9 West, Webster Parish, Louisiana

II. Well location (legal description)

300' south and 350' east of the Northwest Corner of the Northwest Quarter of the Southeast Quarter, Section 26, Township 21 North, Range 9 West, Webster Parish, Louisiana.

III. History, system planning, construction & operation.

This well was drilled in 1964 to dispose of cooling tower overflow and other waste water from a gasoline plant at this same location.

IV. Geology & Geohydrology

A. Regional geologic setting: -- The well is located on the northeast flank of the Sabine uplift and the regional dip in this area is to the northeast. The stratigraphic section consists of Cretaceous and Tertiary sands and clays.

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LA. GEOLOGICAL SURVEY

IV. Geology & Geohydrology, continued

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included -yes____; no____).

(Ground elevation _____) (Total well depth_____)

Datum for depth measurement _____

Name	Age	Depth (Top)	Thickness	Lithologic Description
--				

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (Top)	Thickness	Character and Areal Distribution
--				
Injection zone - 1645' to 1780'				

D. Engineering characteristics of injection units

1. Porosity:
2. Permeability:
3. Original Reservoir Pressure: --
4. Reservoir Temperature: --
5. Chemical Character of Formation Water: --
6. Reservoir Fracture Pressure: --

IV. Geology & Geohydrology, continued

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality

F. Mineral Resources (oil and gas, coal, brines, etc.)

No mineral resources were reported.

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing (Weight & Kind)	Size	Depth Set	Type & Amount of Cement
Surface	9"				
Intermed.	[illegible]	[illegible]	[illegible]	1155	200 SKS Std Jnl 50 SKS COM
Injection	4 7/8		2 3/8"	1025	
Other					

Describe bottom hole completion method: Perforated 1049' - 1069' and 1078' - 1088' W/4 shots per foot

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: _____

VI. Description of surface equipment

A. Holding tanks & flow lines Pump suction vat is of concrete 20' square X 5' deep. Float controlled pump switch.

B. Filters _____

C. Pumps Byron Jackson

D. Other _____

VII. Cores, samples, & Logs

A. Cores

From -- to _____ Recovery _____

" " " "

" " " "

" " " "

" " " "

B. Drilling Logs

____ Drillers Log ____ Drilling time

____ Sample log ____ Other: _____

VII. -- Cores, samples, & logs, continued

C. Other logs run

____Resistivity
____SP
____Caliper
____Other
____Gamma ray-neutron
____Temperature
____Cement bond

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Gas processing plant - cooling tower overflow and other waste water

B. Physical & chemical Description -- Not available

C. Volume Approximately 12 gpm per minute

IX. Preinjection waste treatment None

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results
None			

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results
Injection Zones	Acidization	5,000 gal. HCl-reduced injection pressure from 1100psi to 625psi

C. Injection rates and pressures

1. Rate

Date(s)	12-28-64	Average	15Bpm	Maximum	
"	10-01-70	"	15Bpm	"	
"	4-01-71	"	10Bpm	"	
"		"		"	
"		"		"	

2. Pressure (well head _____ bottom hole _____)

Date(s)	12-28-64	Average	450#	Maximum	
"	10-1-70	"	1100#	"	
"	4-1-71	"	625#	"	
"		"		"	
"		"		"	

X. Well operation & operating history

D. Description of operating programs: Well operates intermittently controlled by float switch in suction vat.

E. Operating problems: Gradual pressure increase during injection.

XI. Regulatory aspects.

A. Construction requirements: ---

B. Monitoring requirements: ---

C. Restrictions on operating procedure: ---

XII. Economics

A. Total & unit costs of construction $12,000.00

B. Operating costs Approximately $100.00 per month

XIII. Source(s) of Information and Published References

Louisiana Geological Survey

I. Operating Company & General Well Location

Pontchartrain Works, E. I. du Pont de Nemours & Company - St. John the Baptist Parish, La Place, Louisiana. The site is located on the East Bank of the Mississippi River between La Place and Reserve, Louisiana.

II. Well location (legal description)

Pee Id. S.W.D. No. 1; Sec. 20; T-11S; R-7E; St. John the Baptist Parish. (Normally referred to as Pontchartrain Works Disposal Well No. 1)

III. History; system planning, construction & operation.

The No. 1 well was drilled and completed under Louisiana Department of Conservation Work Permit No. S.W.D.II-4. Completion date was July 27, 1962. The well completion was designed for injection of NaCl brine resulting from the production of ny on intermediate neoprene. Surface facilities including storage, feed lines, filters, and appropriate instrumentation are provided for handling the waste stream.

Injection was commenced September 28, 1964. Operation of this facility has been on a non-continuous basis.

IV. Geology & Geohydrol.

A. Regional geologic setting: Homoclinal dip with maximum dip of 140 feet per mile at 4000 ft. in a south-southwest direction. The well is located on the east flank of the Mississippi embayment which is on the southern margin of the Gulf Coastal Plain. The area in which the well is located has a monoclinal dip with a maximum dip of 140 ft. per mile in a south-southwest direction. The stratigraphic section consists of Miocene through Recent sands, clays, and shales.

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included -yes X ; no ___).
(Ground elevation 17 ft. above sea level) (Total) well depth 5232 ft.)
Datum for depth measurement: Ground Level

Name	Age	Depth (top)	Thickness	Lithologic Description
Miocene & Younger			5232 ft.	Sand and Shale

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thickness	Character and Areal Distribution
5000 Ft. Sd.	Miocene	5000 Ft.	140 Ft.	Sand-Infinite
4800 Ft. Sd.	Miocene	4845 Ft.	115 Ft.	Sand-Infinite
4600 Ft. Sd.	Miocene	4680 Ft.	130 Ft.	Sand-Infinite
4300 Ft. Sd.	Miocene	4300 Ft.	380 Ft.	Sand-Infinite
3600 Ft. Sd.	Miocene	3600 Ft.	110 Ft.	Sand-Infinite
3000 Ft. Sd.	Miocene	2980 Ft.	115 Ft.	Sand-Infinite
2600 Ft. Sd.	Miocene	2600 Ft.	210 Ft.	Sand-Infinite
2400 Ft. Sd.	Miocene	2400 Ft.	195 Ft.	Sand-Infinite
2100 Ft. Sd.	Miocene	2100 Ft.	260 Ft.	Sand-Infinite
1900 Ft. Sd.	Miocene	1850 Ft.	140 Ft.	Sand-Infinite

D. Engineering description of injection units

1. Porosity: 25% in the 5232 Ft. Sand
2. Permeability: 2 Darcy in the 5232 Ft. Sand
3. Original Reservoir Pressure: 2178 psi at 5232 Ft. (Calculated)
4. Reservoir Temperature: 100° F at 5232 Feet (Measured)
5. Chemical Character of Formation Water: These samples were taken at 5232 ft. in Dr. Funk's No. 1 (Depew) Well.

Chloride Ion - 5400 ppm
Bicarbonate Ion - 170 ppm
Sulfate Ion - 0 ppm
pH - 7.2
Total dissolved solids - 7,500 ppm

6. Reservoir fracture pressure: 3361 psi (Calculated) 5232 feet.

These samples would have been contaminated by fluid used in the well work actually.

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thick-ness	Character	Chemical Quality
Shallow Sand	800 ft.	800 ft.	Sand	No Data

F. Mineral Resources (oil and gas, coal, brines, etc.)

No mineral resources were reported.

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing: Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface					
Intermed.					
Injection					
Other					

Describe bottom hole completion method: [illegible]

6-70

V. Well design and construction, continued

B. Packers, centralizers, well head equipment, etc:

1- No Packers

2- A differential valve tool was positioned at 1034 feet.

3- Spring steel centralizers were run on 90 ft. spacing on the 5 1/2 inch casing.

VI. Description of surface equipment

A. Holding tanks & flow lines Storage tanks and a clarifier provide combined holdup time of approximately 1.5 days. This is combined with additional storage surge capacity to handle up to 10 inches of rainfall. This system is also used for blending the waste material.

B. Filters Primary and secondary filters are provided to remove solids down to 10 microns.

C. Pumps 2 stage centrifugal pumps

D. Other Pressure relief protection is provided along with instrumentation to monitor and record pressure and flow continuously.

VII. Cores, samples, & Logs

A. Coring

From No Cores to None Recovery None

" No Cores [illegible] Done

" No Cores [illegible] None

" No Cores [illegible] None

" No Cores [illegible] None

" No Cores [illegible] None

No Cores [illegible] None

B. Drilling Logs

Drillers Log Drilling time

Sample log Other

VII. -- Open hole logging

C. Other logs run

___Resistivity
X Gamma ray-neutron
___SP
___Temperature
_X_Caliper
___Cement bond
___Other

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Manufacture of nylon intermediate and monomers

B. Physical & chemical Description: Sodium chloride brine with miscellaneous ingredients.

NaCl.....5%-25%	Dissolved Solids....6%-22%
Cyanide.....0-[illegible] ppm	Ph.....7-11
Copper.....0-[illegible] ppm	Density.....1.05-1.20gms
Nitrites(As Adipic Acid).....[illegible] ppm	
Ammonia.....50-150 ppm	

C. Volume 250,000 gallons per day 28,100 gallons per hour; 670 barrels per hour.

IX. Pretreatment must include [illegible] physical blending, pH and chemical treatment, and solid separation and removal are provided.

4. Well completion & operating history

A. Tests *Sample data taken during normal operation.

Date	Duration	Zone Tested	Description of test results
9-24-1969	One Hour *	[illegible]	[illegible]
11-14-1969	One Hour *	[illegible]	[illegible]
3-10-69	One Hour *	[illegible]	[illegible]
4-24-1969	One Hour *	[illegible]	[illegible]
2-7-1970	One Hour *	[illegible]	[illegible]
6-7-1970	One Hour *	[illegible]	[illegible]
9-2-1970	One Hour *	[illegible]	[illegible]
3-16-1971	One Hour *	[illegible]	[illegible]
5-1-1971	One Hour *	[illegible]	[illegible]
6-24-1971	One Hour *	[illegible]	[illegible]

B. Treatments or Stimulation

Zones Treated	Treatment Tested	Description of Treatment and Results
4635'-4665'	Perforation @ 4 shots per foot	Successful
4635'-4665'	Acidize with 6% HF & 10% HCl	Successful
4635'-4665	Swab the well by pulling ~ 100' Sand	Successful
4635'-4665'	Acidize the well with 6% HF & 10% HCl	Successful
3790-3850	Reperforation @ 8 shots per foot	Successful
3790-3850	Acidize with 6% HF & 10% HCl	Successful
3790-3910	Reperforation @ 4 shots per foot	Successful

C. Injection rates and pressures

1. Rate

Date(s) 6-16-1971 Average 120M#/hr Maximum 120M#/hr

" 6-20-1971 " 120M#/hr " 120M#/hr

" 6-30-1971 " 110M#/hr " 110M#/hr

" 7-11-1971 " 120M#/hr " 120M#/hr

" " " "

2. Pressure (well head X bottom hole)

Date(s) 6-16-1971 Average 180psig Maximum 180psig

" 6-20-1971 " 280psig " 280psig

" 6-30-1971 " 250psig " 250psig

" 7-11-1971 " 260psig " 260psig

" " " "

2. Well operation & operating history

3. Description of operating history, the no. I will be used alternate will well no. [illegible] injection interval

E. Operating problems (Should include any conditions have necessitated changes, closing and be brief explain.

XI. Regulatory aspects. (How requ'd by)

A. Construction requirements. Well casing was separated from the bottom shoe to the surface with differential valve seal. The casing was perforated at the disposal injection zone.

B. Monitoring requirements. Injection pressure and volume of waste injected are recorded.

C. Restrictions on operating procedure. Control of injection pressures, material composition, , temperature and solid content maintained.

NOTE: Items listed in section XI include those required by the state and normal practices followed during operation.

10. [illegible]

a. Dealt with [illegible]

[illegible]

b. Operating [illegible] [illegible] [illegible]